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UNIVERSITY OF NORTHERN COLORADO

Greeley, Colorado

The Graduate School

EVALUATION OF MALINGERING CHARACTERISTICS
AND STRATEGIES DURING HEARING ASSESSMENT

A Capstone Research Project Submitted in Partial Fulfillment
of the Requirements for the Degree of
Doctor of Audiology

Sarah Michelle Thompson

College of Natural and Health Sciences
School of Human Sciences
Audiology & Speech-Language Sciences
May 2017

This Capstone Project by: Sarah Michelle Thompson

Entitled: *Evaluation of Malingering Characteristics and Strategies During Hearing Assessment*

Has been approved as meeting the requirement for the Degree of Doctor of Audiology in the College of Natural and Health Sciences in the School of Human Sciences, Program of Audiology and Speech-Language Sciences

Accepted by the Capstone Research Committee

Kathryn Bright, Ph.D., Co-Research Advisor

Tina M. Stoody, Ph.D., Co-Research Advisor

Kathleen Fahey, Ph.D., Committee Member

Accepted by the Graduate School

Linda L. Black, Ed.D.

Associate Provost and Dean

Graduate School and International Admission

ABSTRACT

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Malingering, or the falsification of hearing loss, is a frequent occurrence in many audiology clinics. This occurs particularly frequently when clinicians participate in the evaluation of individuals involved in medico-legal action such as worker's compensation cases. The identification of strategies that are commonly used by individuals attempting to feign hearing loss may be beneficial to clinicians when determining the validity of a hearing loss. Additionally, common audiometric indicators such as audiogram configuration, degree of hearing loss, and intratest consistency are crucial elements to better identify falsified hearing loss.

The purpose of this study was to identify the strategies that are commonly used by individuals attempting to feign a hearing loss. Other aims of this study were to identify the common audiometric configurations, difference between true and malingered auditory thresholds, relationships between malingered pure-tone and speech responses, and common non-verbal responses that may be observed during a hearing assessment with a malingering patient. Malingered thresholds were compared across two participant groups. The first group of participants consisted of individuals who had prior experience with audiometric testing. The second group had no prior experience with audiometric testing. The aim was to identify how experience contributes to malingering strategies as well as

intertest and intratest reliability. Two testing methods were used throughout this study. The Hughson-Westlake procedure was compared to malingered thresholds obtained using the Bekesy tracking test. Pulsed and continuous stimuli were used to evaluate changes in malingerer behavior and response patterns based on the type of tone used.

Data collected during this study indicated that the most common strategies used by malingering individuals were selection and maintenance of consistent intervals between responses, maintenance of an internal loudness memory, and waiting for a perceptible change or distortion in the stimulus before responding. The experienced group of participants often relied on their prior knowledge of audiometric testing to develop malingering strategies. Flat audiometric configurations were produced most frequently by both groups of participants. In general, the experienced malingerers more consistently produced pure-tone averages and speech reception thresholds that occurred within 10 dB HL of one another. Additionally, experienced malingerers tended to produce more hearing loss than inexperienced malingerers. It is important that clinicians understand the common strategies used by malingerers and the common features of malingered hearing assessments to improve their ability to accurately evaluate hearing sensitivity in individuals who are involved in medico-legal cases.

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CHAPTER I

STATEMENT OF THE PROBLEM

Pseudohypacusis is the presence of a disorder without an explainable medical cause (Holenweg & Kompis, 2010). Pseudohypacusis is a common occurrence in the field of audiology. Its detection relies heavily on the audiologist to identify discrepancies between patient reports and objective measures. Audiologists often become aware of a feigned hearing loss when the subjective portion of the hearing evaluation does not match the results from objective measures. In many situations, individuals who feign a hearing loss are termed “malingerers” (Holenweg & Kompis, 2010). The incidence of illness deception in the general population is unknown but the falsification of a condition is estimated to occur in 20 to 50 percent of medico-legal cases including civil law suits and worker’s compensation cases (Poole, 2010).

Given that individuals falsify hearing loss for a variety of reasons, it is beneficial to understand more about their perspective. Motivations for feigning or exaggerating hearing loss include avoidance of blame, compensatory motivations, and removing themselves from difficult circumstances. Malingerers who are trying to avoid blame may be doing so to remove guilt or responsibility from a car accident, workplace incident, or troubling personal encounter. Compensatory motivations may include civil suits and workers’ compensation cases (Erdal, 2002). The most flagrant malingering typically

occurs when the individual believes personal gain is the result of the successful exaggeration of a condition or disorder such as hearing loss (Festinger & Carlsmith, 1959). Individuals may attempt to present a malingered condition to remove themselves from difficult situations such as military service (Jerger & Jerger, 1981). Other hypothesized motivations include using the malingered condition as a coping mechanism for psychological stress. This may include feigning a disorder to obtain attention, to gain revenge, or to seek sympathy. Malingerers may also use the feigned disorder as an alibi to avoid being blamed for a difficult situation (Peace & Masliuk, 2011). For example, a child may feign illness to receive more attention from a parent, an accused individual may be spared from interrogation if he or she is ill, and an employee suffering from a medical condition may receive additional time away from work (Austen & Lynch, 2004).

Despite the motivation, it is the audiologist's responsibility to determine whether an individual is responding honestly during a hearing assessment. Information about the motivations of malingerers can be used to supplement patterned behavioral responses in audiometric evaluations to identify themes that will indicate to audiologists that a hearing loss may not be entirely genuine.

To successfully feign a hearing loss, an individual needs to choose a loudness level above which a response will be given and below which no response will occur. He or she must keep this level consistent throughout the test. This strategy is called "loudness memory" (Rintelmann & Carhart, 1964). Hughson-Westlake audiometry consists of presenting a series of tones that ascend or descend in discrete steps based on the patient's response (Carhart & Jerger, 1959). The Bekesy tracking test uses a series of ascending and descending pure tones (Rintelmann & Carhart, 1964). Due to the

constantly changing tone, it may be challenging for a malingerer to maintain his or her loudness memory to successfully convince the examiner of the falsified hearing loss. Further research was needed to identify which strategies are used by malingerers during a traditional hearing evaluation and on the Bekesy tracking test. Additionally, further research was needed to determine whether one or the other of these testing methods was more difficult for individuals who choose to feign or exaggerate hearing loss. Such information can be used to assist in the identification of malingerers. Therefore, the research questions are as follows:

- Q1 How frequently are typical audiogram configurations (e.g. sloping, rising, flat, trough-shaped, corner audiograms) present when individuals attempt to feign a hearing loss on a Hughson-Westlake or Bekesy tracking test.
- H1 It is expected that the flat configuration will occur most frequently because the aim of malingering individuals will most likely be to produce consistent results. It is likely that malingerers will consider a flat audiogram to be easiest to feign consistently.
- Q2 How does the degree of hearing loss indicated by individuals malingering on the Hughson-Westlake test differ from the degree of hearing loss indicated by individuals malingering on the Bekesy tracking test?
- H2 It is expected that some individuals will provide results that indicate greater degree of hearing loss with the Bekesy tracking procedure and other individuals may provide results indicative of more hearing loss with the Hughson-Westlake procedure.
- Q3 How does the degree of hearing loss indicated by individuals malingering on a hearing evaluation using a pulsed tone differ from the degree of hearing loss indicated by individuals malingering on a hearing evaluation using a continuous tone?
- H3 Based on previous research, if a hearing loss is genuine, the degree of hearing loss should be greater when individuals are tested with continuous tones compared to pulsed tones. However, the Bekesy Type V audiogram suggests that the opposite is true of malingered hearing loss. Therefore, it is expected that malingerers are most likely to produce more hearing loss

when tested using a pulsed tone compared to the degree of hearing loss that will be produced when they are tested using a continuous tone.

- Q4 Are malingered speech reception thresholds (SRTs) in agreement with the pure-tone average of the malingered results from the Bekesy and Hughson-Westlake tests?
- H4 It is expected that malingerers will have difficulty maintaining a consistent loudness memory when comparing pure tones to the loudness of speech stimuli. Malingerers who are experienced with audiometric testing may be more successful at achieving consistency between pure-tone averages and speech reception thresholds. However, it is expected that these values are unlikely to consistently fall within 10 dB HL of one another.
- Q5 How do malingered strategies differ between pure-tone hearing assessment when it is conducted with the Hughson-Westlake technique and the Bekesy tracking technique?
- H5 Malingerers are most likely to use loudness memory to feign hearing loss on the Hughson-Westlake assessment because the stimuli are presented in discrete intervals with a noticeably different loudness level between presentations. During the Bekesy tracking test, malingerers are most likely to rely on timing cues because the intensity of the stimulus changes gradually. This means that malingerers will have more difficulty comparing the intensity of the current stimulus to a previous stimulus.
- Q6 How do strategies used by individuals who have experience with audiometric testing differ from strategies used by individuals who are inexperienced with audiometric testing during the Hughson-Westlake and Bekesy tracking tests?
- H6 Individuals who are informed about audiometric testing are likely to rely on that knowledge. These individuals may select a degree of hearing loss or audiogram configuration that they would like to try to produce. They may try to predict the intensity level of each presentation to determine whether to respond. Individuals who are uninformed about audiometric testing are more likely to rely heavily on loudness memory to determine whether to respond. These individuals will not be able to reference prior knowledge of the test procedures or prior experience undergoing hearing testing. Therefore, they will most likely create arbitrary rules to decide how loud a tone must be before responding.
- Q7 Do participants demonstrate a difference in type and number of non-verbal and paralinguistic responses (e.g., grimacing, shifting, and changes in

facial expression) when malingering during the Hughson-Westlake and Bekesy tracking tests?

- H7 Malingers are likely to display more of these behaviors during the test they feel is more difficult to complete. It is expected that the increased challenge of the more difficult test will increase the feeling of nervousness experienced by malingerers, which will increase the frequency of these behaviors. Overall, the type of behavior is likely to vary based on the individual rather than the test procedure.

CHAPTER II

REVIEW OF THE LITERATURE

Pseudohypacusis: Definitions and Related Terms

A frequent occurrence in medical practices is the presence of an individual who attempts to feign the existence or severity of a medical disorder or condition. The incidence of these situations in the general population is unknown but the falsification of a condition is estimated to occur in 20 to 50 percent of medico-legal cases (Poole, 2010).

In the broad medical community, the presence of a condition or disorder that appears without an explainable, medical cause is known as “illness deception.” Cases of illness deception are differentiated based on the motivations of the individual with the feigned condition. A condition in which psychological factors have resulted in the patient believing he or she has the feigned illness, disability, or symptom is called a “factitious disorder.” If the patient is creating the condition or symptoms to avoid work or to receive monetary gain, the behavior is called “malingering.” Identification of feigned conditions is difficult as it relies on professionals to recognize inconsistencies, which cannot be medically explained between the patient history and the examination results (Poole, 2010).

In the case of hearing loss and disorders of the auditory system, several terms have been used to describe a false or exaggerated hearing loss. Such terms include

“pseudohypacusis,” “non-organic hearing loss or deafness,” “exaggerated hearing loss,” and “functional hearing loss or deafness” (Mahdavi, Nooshin, & Amiri, 2011).

Additional terms include “psychogenic hearing loss,” “hysterical deafness,” “conversion hearing loss,” “dissociative deafness,” “simulated hearing loss,” “feigning,” and “malingering” (Austen & Lynch, 2004). These terms are differentiated by the motivation, whether conscious or unconscious, of the individual with the feigned condition.

Additionally, the terms are differentiated by the presence of psychological factors, which may lead the individual to believe that the feigned condition is genuine. These terms may also carry different implications to some clinicians (Jerger & Jerger, 1981).

Many definitions have been used to describe the presentation of a hearing loss without medical cause. Chaiklin and Ventry (1965) described functional hearing loss as the presence of “intratest or intertest audiometric discrepancies as well as medical examinations that rule out apparent organic conditions that might account for the discrepancies” (p. 77). Veniar and Salston (1983) defined pseudohypacusis as “an apparent loss of hearing for which there are no demonstrable organic findings to explain the symptoms” (p. 34). Martin (2002) provided another definition of pseudohypacusis, “hearing loss that appears greater than can be explained on the basis of the auditory system” (p. 584). Austen and Lynch (2004) prefer to describe this phenomenon as “responses to a hearing test indicating a deficit greater than can be explained by organic pathology because this definition implies as little as possible about the cause of the malingered hearing loss” (p. 450).

Regardless of definition, pseudohypacusis is a broad term to describe a hearing loss that is present without an identifiable cause. As this encompasses a wide range of

conditions, pseudohypacusis is divided into three categories distinguished by motivation.

The categories are “aggravation,” “psychogenic hearing loss,” and “malingering.”

Aggravation is the presence of an exaggerated hearing loss. In these cases, the individual may possess a mild form of hearing loss but the individual has exaggerated the severity to convince the clinician that the loss is more severe than it is in reality. Individuals whose hearing loss is classified as “psychogenic” believe that they have a genuine hearing loss. In these cases, psychological influences have triggered the onset of the hearing loss even though a true disorder of the auditory system does not exist. Individuals who are identified as “malingerers” have normal hearing but falsely claim that a hearing loss is present (Holenweg & Kompis, 2010).

Motivations of Individuals with Malingered Hearing Loss

Individuals who choose to intentionally report symptoms related to a malingered hearing loss do so for a variety of reasons. The reasons are varied but often fall into three categories. These categories include compensatory motivations, avoidance of blame, and using the feigned condition to remove the individual from a difficult situation (Erdal, 2002).

Compensatory motivations are motivations in which the individual seeks to acquire personal gain. The gain can be in the form of money, property, or items and services of value. Common examples are civil law suits and worker’s compensation cases (Erdal, 2002). Compensatory motivations in which the individual will earn money as a direct result of the malingered disorder are most commonly the situations in which the individual malingers most flagrantly. This is even more common when the individual is

likely to earn money if the malingering is successful and the individual believes that another person or organization is at fault for necessitating their choice to malingering (Festinger & Carlsmith, 1959). Additionally, individuals tend to take greater risks when malingering for personal gain than they will take if the malingering is an avenue to avoid a potential threat or blame (Highhouse & Yuece, 1996).

The second common motivation for malingering is the avoidance of blame. For example, an individual involved in a car accident may choose to feign a disorder which mitigates his or her role in causing the accident. Individuals are less likely to malingering if they genuinely believe they are at fault for their actions (Erdal, 2002). Additionally, individuals tend to take greater risks when malingering for personal gain than they will take if the malingering is an avenue to avoid a potential threat or blame (Highhouse & Yuece, 1996). Individuals are also less likely to malingering if they believe they are at fault even if they stand to receive compensatory gain from malingering (Erdal, 2002).

The final category for motivations related to a malingered condition is the use of the malingered disorder to remove the individual from a challenging situation (Erdal, 2002). Jerger and Jerger (1981) stated that avoiding military service was a common reason at that time for an individual to choose to feign a hearing loss. Peace and Masliuk (2011) stated that individuals will feign several conditions to relieve psychological stress, gain attention the individual feels is lacking, gain revenge, seek sympathy, or provide an alibi. Despite the motivation for malingering, individuals who choose to malingering a hearing loss or another condition have always been triggered to do so by some factor in their life (Erdal, 2002).

Clinical Indicators of Exaggerated or Malingered Hearing Loss

In routine, clinical practice, individuals with a malingered hearing loss are identified through a variety of methods. Clinicians may become suspicious of a malingered hearing loss through casual interaction with the patient. Clinicians may observe excessive nervousness in the patient. The patient may also speak in an unusually loud voice and may frequently reference his or her hearing deficit without prompting. Additionally, the patient may exaggerate his or her attempts to hear the clinician or to read the clinician's lips. During conversations with the patient, clinicians may notice that he or she is not emotionally distraught about the hearing loss. The patient may have a mild, casual reaction when the clinician explains the extent and ramifications of the hearing loss. In some situations, the patient may demonstrate poor hearing during the evaluation but will not struggle to communicate in casual conversation (Jerger & Jerger, 1981).

Referral source is another indicator to clinicians that a hearing loss or other medical condition may not be entirely factual. To evaluate referral source, Mittenberg, Patton, Canyock, and Condit (2002) distributed a survey to medical practitioners. The survey contained questions regarding practice demographics, sources of referral, and the percentages of cases which likely involved malingered or exaggerated symptoms. The researchers determined that approximately 30 percent of cases with exaggerated or malingered symptoms were personal injury cases referred by a plaintiff's attorney, plaintiff's doctor, defense attorney, or insurance company. Approximately 32 percent of

patients with malingered symptoms were referred by a defense or prosecuting attorney as part of a criminal investigation.

Patients with a malingered or functional hearing loss may also struggle to describe the nature and onset of the loss when questioned about it. The details surrounding the loss may be erroneous or the patient may not provide specific details about the circumstances in which the hearing loss was obtained. In other cases, patients have described sudden onsets for malingered conditions and the hearing loss is associated with a specific incident. Patients may also describe tinnitus along with the symptoms of their hearing loss. Some patients have claimed that tinnitus causes confusion and presents the individual from being able to complete the audiometric evaluation.

The lack of crossover and a shadow curve when stimuli have exceeded the interaural attenuation is another early indicator that pure-tone audiometry results may include a component of exaggeration or malingering (Jerger & Jerger, 1981). Crossover occurs during audiometric testing when the signal presented to one ear reaches an intensity level that is great enough to allow the signal to cross to the opposite ear. Crossover is prevented using effective masking to prevent the non-test ear from perceiving the stimulus intended for the test ear. When masking is not used, a shadow curve can be seen in the audiogram. A shadow curve is a phenomenon in which the thresholds of the poorer ear mimic those of the better ear because the stimulus crosses over and the better ear responds (Roeser & Clark, 2007).

Immittance audiometry will often reveal type A tympanograms and normal acoustic reflex thresholds if the hearing loss has been malingered. These test results reveal normal middle ear function. Results of speech audiometry may also be an initial

indicator to clinicians that the hearing loss is exaggerated or malingered. In some instances, the speech reception threshold (SRT) testing will reveal a threshold that is significantly better than the patient's pure-tone responses and should not be heard if the hearing loss is genuine (Jerger & Jerger, 1981).

Malingering: Previous Research and Case Studies

Rees and Tombaugh (1998) conducted a study to assess a neuropsychological clinical tool called the Test of Memory Malingering (TOMM). The researchers recruited twenty students from an introductory psychology course and randomly assigned each student to one or two groups. The first group was asked to mangle and then respond to the test honestly, the second group completed the experiment in the reverse order. The researchers provided the participants with a scenario stating that the participant should pretend to have experienced a car accident which resulted in hospitalization. The scenario indicated that the participant has begun feeling better but was advised by an attorney that a large financial settlement could be earned if the participant had lingering brain damage. The participants were given a monetary incentive based on their performance on the test to increase their motivation to mangle. They were also asked to research the TOMM and the effects of head injury prior to the experiment because true malingerers are likely to have undergone repeated tests and will have some experience with the procedure. After the study, the researchers used a questionnaire to ensure that the participants had complied with the instructions given in the scenario.

One of the most common methodologies for assessing malingering is the forced-choice paradigm. In this situation, the subject is exposed to a sensory "signal" and is

asked to respond as though he or she is unable to perceive the stimuli. Following exposure to the signal the researcher presents the signal again along with a distractor signal. The subject is asked to choose which signal was presented initially. In this two-alternative forced-choice task method, the subject should answer correctly 50 percent of the time by chance (Iverson & Franzen, 1996).

Research related to hysterical blindness indicates that the percentage of accuracy on a two-alternative forced-choice task compared to the probability of answering correctly can provide an indication of the likelihood that a condition is feigned. A subject who can perceive the stimuli should achieve results that are better than those that would be expected if the subject were guessing. A subject who is responding significantly below the 50 percent mark is likely to be perceiving the signal but ignoring it and choosing to respond as though the stimulus is imperceptible (Theodor & Mandelcorn, 1973).

Pankratz, Fausti, and Peed (1975) adapted the two-alternative forced-choice task to evaluate malingered hearing loss. The subject was a 27-year-old male with a history of malingered and exaggerated symptoms. The individual repeatedly attempted to gain compensation for the malingered and exaggerated disabilities. During the assessment for malingered hearing loss, the subject was presented with temporal intervals during which the researcher turned on a red light or a blue light. A 1000 Hz tone was randomly presented during one of the intervals. The subject was asked to identify which interval contained the tone. The subject indicated a 90 dB HL threshold at 1000 Hz so the tone was presented 50 dB below threshold, at 40 dB HL. The subject correctly identified 36% of the tones even though the tones were presented in a range that should not have been audible. The researchers concluded that it was likely that the subject perceived all

presentations of the tone but selectively chose when to answer correctly and incorrectly. This accounts for results that were below the expected score of 50 percent which should have been achieved if the tones were inaudible.

Another study was conducted by Hanley and Tiffany (1954) who described a case in which an employee was unloading a truck in his workplace. The individual was hit in the ear with a hand truck that was dropped by a coworker. The initial assessment showed an average loss of 50 dB and 70 dB in the right and left ears, respectively. The audiologist believed that the individual might be malingering. Following a retest, the individual claimed that he was skilled at lip-reading and relied upon it to communicate. However, in the workplace, the individual was observed to participate appropriately in conversation even when visual cues were not available to assist with communication. Additional retests conducted by another audiologist showed thresholds in the severe to profound range with no response for frequencies above 1000 Hz. At this point, the clinician noted that the audiometric tests were not consistent from one evaluation to another. The pure tone results did not match speech responses and the individual did not show any signs of speech deterioration or difficulties despite the significance of the indicated hearing loss. Since the inconsistencies in the test results caused the clinicians to believe this individual likely had normal hearing and was feigning a hearing loss, the clinicians administered the delayed auditory feedback test. This test requires the subject to read a passage into a microphone while listening to a recording of his or her own voice played back with a delay of approximately one-fifth of a second. Individuals who can hear the recording should experience deterioration in speech (Yates, 1963). In this instance, the delayed auditory feedback test showed that the individual could hear his

own speech when it was replayed and that the introduction of auditory stimuli made it challenging for him to continue responding as though his hearing loss was genuine. Following the test battery, the clinicians concluded that the individual was malingering or exaggerating. They were unable to identify true thresholds but estimated that the individual had thresholds of 40 dB HL or better.

Malingering-Simulation Paradox

Rogers and Cavanaugh (1983) described a phenomenon called the “malingering-simulation paradox.” This paradox suggests that it is difficult to determine if or how the results of a malingering simulation will generalize to true malingerers. The theory implies that individuals who are asked to malingering as part of a research study do not have the same intrinsic motivation as individuals who malingering for reasons that have a genuine impact on their life and well-being.

The “malingering-simulation paradox” has been used to criticize previous research surrounding malingering and motivations. Critics of previous research have claimed that because of the “malingering-simulation paradox” it is impossible to perfectly simulate a true malingering situation. Fundamental differences exist between genuine malingerers and research participants (Rogers & Cavanaugh, 1983). Research participants lack genuine motivation for success and are often less skilled at malingering. They also lack previous knowledge of and experience with test procedures (Faust & Ackley, 1998). Thus, researchers must account for motivations and “candidate variable” when conducting experimental research. It is recommended that conclusions made from experimental tests be examined in clinical settings to assess the generalizability of claims (Rogers, 1990).

Classification of Audiometric Configuration and Degree of Hearing Loss

The use of a classification system for pure-tone test results allows audiograms to be coded for comparison. Carhart (1945) described a classification system developed at the Deshon General Hospital in Butler, Pennsylvania. The classification system uses a small number of major categories which describe basic curve types found in everyday test results. The Deshon system also introduced basic categories to describe the degree of hearing loss. Descriptive terms are used to indicate minor deviations from the general categories for audiogram configuration.

Five major categories for audiometric configuration were identified using the Deshon classification system. The first category, flat, refers to an audiogram that has an approximately equal degree of hearing loss at each frequency. Gradual downward sloping audiograms have a progressively greater degree of hearing loss in the high frequencies. To be considered gradually downward sloping, the increase in degree of hearing loss must be between 5 and 10 decibels per octave. A marked downward sloping audiogram also has a progressive increase of severity in the high frequencies but the increasing severity occurs at a rate of 15 to 20 decibels per octave. The fourth category, rising, is used to describe hearing losses which have progressively less hearing loss in higher frequencies. The final category, trough, describes hearing losses which have the greatest severity of hearing loss in the mid-frequency range with better hearing at the high and low frequencies (Carhart, 1945).

Additional audiogram configurations were described by Roeser and Clark (2012). Roeser and Clark identified nine common audiogram configurations which they named

flat, sloping, rising, precipitous, trough, inverted trough, high frequency, fragmentary, and 4000 to 6000 Hz notch. The definitions of flat, sloping, rising, and trough audiograms agree with those described by Carhart. Roeser and Clark renamed the marked downward sloping audiogram and titled it “precipitous.” An inverted trough configuration is used to describe an audiogram in which the best hearing sensitivity is in the mid-frequencies and the greatest degree of hearing loss occurs in the high and low frequency regions. A high frequency hearing loss occurs when the individual has relatively normal hearing below 2000 to 3000 Hz and has limited hearing above that range. A fragmentary audiogram has no response in the mid and high frequency ranges with some responses in the severe-profound range in the low frequencies. The final configuration, 4000 to 6000 Hz notch, occurs when hearing is normal below 3000 Hz. Above this point, the hearing decreases significantly but recovers at 8000 Hz.

In addition to configuration, audiograms are described in terms of degree of hearing loss. Goodman (1965) described a classification system for degree or magnitude of hearing loss. Adult hearing is within normal limits if the thresholds occur at 25 dB HL or better. A mild hearing loss exists between 26 and 40 dB HL. Thresholds are in the moderate hearing loss range when they occur between 41 and 55 dB HL. The moderately-severe hearing loss range is 56 to 70 dB HL. A severe hearing loss consists of thresholds between 71 and 90 dB HL. Finally, a hearing loss falls in the profound range if the thresholds occur at 91 dB HL or greater. This system was modified by Clark (1981). This change limited the range of normal hearing to -10 to 15 dB HL and added the slight hearing loss classification from 16 to 25 dB HL. In some instances, the slight classification is removed and normal hearing is classified as 20 dB HL or better. In this

situation, a mild hearing loss is considered any threshold that falls between 21 and 40 dB HL.

Hughson-Westlake and Bekesy Audiometry

According to the American Speech-Language-Hearing Association (ASHA, 2005), three general methods for pure-tone testing exist. These methods are Hughson-Westlake, or conventional, audiometry; Bekesy, or automatic, audiometry; and computerized audiometry. When using conventional testing techniques, ASHA suggests that clinicians avoid giving visual cues. It's also important to ensure that the clinician is easily able to observe responses from the patient during testing. The recommended procedure is to familiarize the patient with the task while using a tone that is easily perceived. After that, the clinician should begin by presenting a 1000 Hz continuous pure-tone. The tone should be increased gradually until a response occurs. When the participant successfully responds to a tone, the tone intensity should be decreased by 10 dB HL. When a patient fails to respond to the tone, the tone should be increased by 5 dB HL. The threshold is defined as the lowest intensity level at which the patient can respond fifty percent of the time. However, to ensure accurate results, the patient should respond correctly to a minimum of two out of three presentations (ASHA, 2005).

Bekesy audiometry was introduced in 1947. The test was designed to present continuous stimuli to eliminate the variable test tone duration that may occur when using the traditional Hughson-Westlake method. Bekesy audiometry consists of presenting either a continuous steady-state or pulsed tone which gradually ascends or descends in frequency. The tone is controlled by the patient who is instructed to respond when the

stimuli becomes alternately audible and inaudible to reverse the direction of the tone. The intensity of the tone is traced on a graph as it increases and decreases to form a sawtooth-shaped waveform. Descending excursions of the wave indicate that the tone was audible to the patient and ascending excursions indicate that the tone was inaudible (Hughes & Johnson, 1975). Threshold is the intensity level which falls at or near the midpoint between the ascending and descending excursions (Reger, 1952).

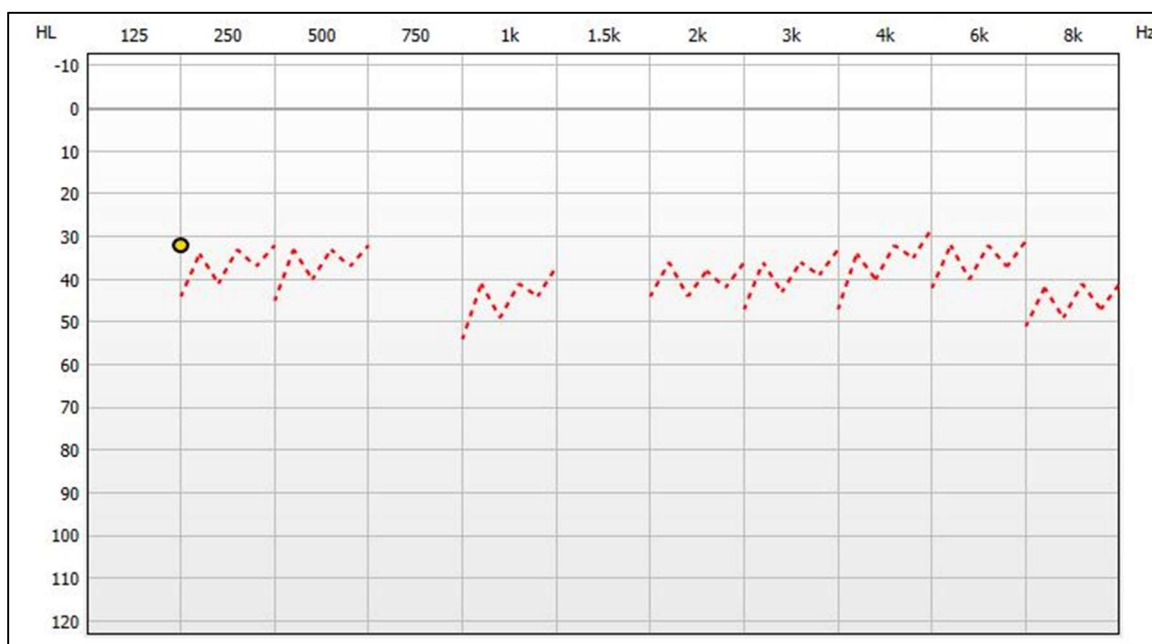


Figure 1. Sample tracing from Bekesy tracking test with pulsed tone.

Comparisons of pulsed and steady-state tones have also been used to identify five characteristic audiograms, each indicative of a different state of the auditory system. Type I audiograms consist of approximately equal responses when the stimuli are presented as pulsed or as steady-state. This is indicative of normal hearing sensitivity or of conductive pathology. Type II audiograms contain a separation in which steady-state responses occur at a greater intensity level than pulsed responses above 1000 Hz. This is indicative of a cochlear pathology. Type III audiogram steady-state responses differ

significantly from pulsed responses and the steady-state responses decline rapidly. This configuration is consistent with retrocochlear pathologies. Type IV audiograms are also consistent with retrocochlear pathologies. These audiograms contain a worsening of steady-state responses below 500 Hz (Hughes & Johnson, 1978). Jerger and Herer (1961) identified the fifth configuration seen in Bekesy audiometry. Type V audiograms differ from the others because the steady-state responses indicate better hearing sensitivity than pulsed responses. This configuration is indicative of a non-organic or malingered hearing loss. The Bekesy Type V tracing was confirmed in subsequent studies by Resnick and Burke (1962), Peterson (1963), and Rintelmann and Harford (1963).

Nonverbal and Paralinguistic Indicators of Deception

Meta-analysis studies typically found in psychology literature, have been conducted to identify several nonverbal indicators that are commonly associated with deception of any kind (DePaulo, 1992; DePaulo, Stone & Lassiter, 1985; Ekman, 1989; Zuckerman & Driver, 1958; Zuckerman, DePaulo & Rosenthal, 1981). Such indicators may be observable during clinical practice to indicate that further assessment should be conducted to rule out the possibility of malingering. Individuals who are consciously trying to deceive or manipulate a situation are often seen to have a greater than usual number of disturbances in their speech. This can be an increased number of filler phrases, change in vocal pitch, increased time between phrases, avoidance of eye-contact, and slower rate of speech. Additionally, deception can be associated with increased shifting of the body, increased or decreased movement of the hands, fingers and feet, and increased self-touches (DePaulo, 1992; Ekman, 1989). These types of indicators may be

observed by audiologists but they are rarely reported or documented during a clinical evaluation.

Loudness Memory

To compare two sounds, an individual must memorize the first sound during the delay between the presentation of the first and second sounds. Two methods of memorization can be used to complete this task. The first method, trace mode, requires the individual to compare the sensation produced by the first sound to the sensation experienced when listening to the second sound. The listener will rehearse the sound during the delay to improve the accuracy of the memory related to the sensation it produced. For the second method, context-coding mode, the listener compares a categorical representation of the first sound to a categorical representation of the second sound. This requires the listener to compare each sound to his or her own general knowledge of sounds to identify the categorical qualities that are appropriate for the given sound. This method is typically less accurate than the trace mode method for memorization (Durlach & Braida, 1969). In both instances, the accuracy of the memory of the first tone is dependent on the length of the delay between the first and second tones (Keller, Cowan & Saults, 1995).

An individual who attempts to feign hearing loss must create a mental gauge for the loudness of stimuli. The individual will respond to sounds above the chosen threshold and will fail to respond to sounds below the chosen threshold. The individual must remain consistent throughout the evaluation. The maintenance of this threshold is called loudness memory and it is difficult to maintain as stimuli change. Stimuli consisting of pulsed tones are often perceived to be less loud than stimuli consisting of steady-state

tones. In these instances, an individual feigning hearing loss may produce different thresholds for each stimulus due to the difficulty of maintaining loudness memory (Rintelmann & Carhart, 1964).

Basic Qualitative Research

It is possible to evaluate malingered hearing loss using several methods. Malingered hearing loss may be evaluated by identifying characteristics of the audiometric results that appear most frequently during falsified hearing tests. However, it is also beneficial to identify the motivations, strategies, and thought process of individuals who choose to feign hearing loss. Evaluating qualitative data are likely to provide greater insight to clinicians who encounter malingering patients in clinical practice. The purpose of qualitative research is to understand the meaning a phenomenon has for the individuals involved (Crotty, 1998).

Merriam (2009) identified and defined six common approaches to qualitative research. The types of qualitative research are basic qualitative research, phenomenology, grounded theory, ethnography, narrative analysis, and critical qualitative research.

The first approach, basic qualitative research, is most applicable to this research study. Basic qualitative research is commonly used in the fields of education, administration, health, social work, counseling, and business. Basic qualitative research typically takes the form of an interpretive study. This type of research involves evaluating the way individuals interact with and interpret their social world (Merriam, 2009). This study was completed using this research model because the aim was to evaluate the way in which malingerers interpret the hearing test experience and the way in which they modified their behavior to meet their goals during that experience.

The goal of basic qualitative research is to uncover and interpret meaning from a given phenomenon or experience. Researchers seek to obtain information from individuals about their interpretation of experiences and the meaning that is attributed to their experiences (Crotty, 1998). Researchers who undertake basic qualitative research studies may use several forms of data. Data may be collected through observation, interviews, or document analysis. The theoretical framework specific to the study drives the type of questions that are asked, observations that are made, or which documents are relevant for analysis (Merriam, 2009).

Interpretivism

In addition to selecting an appropriate qualitative research model, it is necessary to identify the theoretical framework that applies to this research study. The theoretical framework is the “philosophical stance lying behind a methodology.” The theoretical framework determines the perspective from which the research gathers data and provides context to organize and analyze the data (Crotty, 1998).

Interpretivism is the theoretical framework used to collect and analyze data in this study. The aim of interpretivism is to understand and explain social reality. Interpretivism focuses on deriving meaning from the way that an individual or group takes an interest in the social world. For example, the aim of this study was to identify the way in which malingerers perceive, comprehend, and interact with their social world during the hearing test process. The way in which malingerers behave and respond to a hearing test provides insight with which to derive meaning about their strategies and goals. Interpretivism is based on the naturalistic approach to data collection. Naturalistic methods of data collection include the use of interviews and observation. As a result of this approach,

meanings derived from the data typically emerge toward the end of the data collection process (Crotty, 1998).

Data Collection Using Effective Interviewing Techniques

Qualitative research often includes the use of interviews to obtain first-hand data from the subjects involved in the study. Merriam (2009) described three types of interviews. The first type, highly structured interviews, requires the most preparation and allows the least spontaneity during the interview. The questions to be asked are predetermined. The wording and order of the questions are carefully considered beforehand. This type of interview is often used to obtain demographic data. The second type of interview, semi-structured, is slightly less rigid. The interviewer prepares an interview guide that includes a variety of more and less structured questions. The interview is guided by prepared questions but the interviewer does not have to use a specific wording or order. The final interview type is unstructured and consists of an informal conversation that uses open-ended, exploratory questions. This approach is used when a researcher is trying to learn about the interview topic and it is generally used in ethnographic studies (Merriam, 2009).

Regardless of interview type, it is essential to ask thoughtful, clear questions that will yield valuable data. The questions need to be in a familiar language to the respondent and should be phrased so that they are easily understood. Technical jargon should be avoided. Follow-up questions are necessary to inquire about feelings, values, and opinions. Demographics and questions related to relevant background experiences are also needed to produce a well-rounded interpretation (Patton, 2002). Interview sessions

should be repeated and data collection should be continued until the point of saturation is reached. Saturation is the point at which the researcher no longer receives information that has not previously been described in prior interview responses (Glaser & Strauss, 1967).

Throughout the interview, the conversation should be recorded for future study. The most common method is the use of a tape or digital recorder. This may produce initial nervousness from the respondent but most individuals eventually forget that they are being recorded. If a recorder is not available, the researcher may take written notes during the interview. This is less ideal as it inhibits the natural flow of the conversation. The least desirable method for recording interviews is to immediately document as much information as can be remembered following the interview. This is not preferred as it can lead to forgotten or misinterpreted details (Merriam, 2009).

Following the interview, a process called member checking is often used to ensure that the researcher has accurately represented the emerging data (Maxwell, 2005). Member checking is used to ensure validity of the study. However, it shifts the role of ensuring validity from the researcher to the participants (Creswell & Miller, 2000). This process involves providing respondents with summaries of the data or transcripts from the interview. The respondent is asked to review the information and provide additional feedback or insight to ensure that the experience has been interpreted accurately. This also gives respondents an opportunity to review the topic and add any details that may have been forgotten during the initial interview. This process can be done at the end of the study or throughout the process (Creswell & Miller, 2000; Maxwell, 2005).

Member checking can be completed using a variety of methods. In some instances researchers may conduct a focus group with participants to review the data and discuss the validity of the conclusions reached. Other researchers prefer to ask participants to review raw data (interview transcripts, artifacts, observational notes, etc.). Members are asked to review their interview responses and make changes as necessary if they feel that the data are not representative of their experience. The member checking process adds credibility to the qualitative study by ensuring that the data are accurate and thorough (Cresswell & Miller, 2000).

Summary

Pseudohypacusis is the presence of a disorder without an explainable, medical cause (Holenweg & Kompis, 2010). Pseudohypacusis is present in 20-50% of medico-legal cases (Poole, 2010). Pseudohypacusis is categorized based on the motivations of the individual. Malingering is an instance in which an individual intentionally feigns a condition or disorder (Austen & Lynch, 2004). During hearing tests, a malingering individual is likely identified through inconsistencies across the test battery (Jerger & Jerger, 1981). Other indicators of feigned hearing loss may lie within audiogram configuration or degree of hearing loss (Clark, 1981; Roeser & Clark, 2012). However, it is also beneficial to understand the strategies used by malingerers when they attempt to feign hearing loss. These strategies can be identified through a basic qualitative research model and under the theoretical framework of interpretivism (Crotty, 1998; Merriam, 2009). It is also important evaluate malingering studies through the lens of the malingering-simulation paradox. This phenomenon was described by Rogers and Cavanaugh (1983) and states that it is not possible to generalize the findings of a study

with simulated malingerers because it is impossible to replicate the malingering scenario and the intrinsic motivation of a malingerer.

CHAPTER III

METHODOLOGY

Participants and Setting

Twenty students between 18 and 30 years old, with normal hearing were voluntarily recruited from the University of Northern Colorado. Participants were included in the study if they could demonstrate normal hearing sensitivity with responses at 20 dB HL between 250 and 8000 Hz. Participants were excluded if they were unable to complete the testing process using English. Since malingers are often informed about the disorder they will feign and about the test procedures, ten participants were currently enrolled in the Doctor of Audiology program. The remaining ten participants were enrolled in other areas of study for comparison purposes. To avoid confounding variables, no speech-language pathology, audiology undergraduate, or special education students were included in the study. These students receive a small amount of training in audiometry so they cannot be considered “inexperienced” but they do not have enough training to be part of the experienced group of participants.

Participants were tested in the University of Northern Colorado Speech-Language Pathology and Audiology Clinic. All participants were recruited via a convenience sampling based on their previous personal relationship with the researcher. Participants were recruited via in-person conversations and through email. This research was

conducted under an approved University of Northern Colorado Institutional Review Board protocol (Appendix A). All participants signed the informed consent form before participating in the study (Appendix B).

Data Collection Measures and Procedures

Data collection began by reviewing the consent form with the participant and answering any questions related to the test procedures. After the consent form was completed, participants were seated in a sound booth. An observer was present for each data collection session. The observer was introduced to the participant and the observer's purpose was explained. The observer was then seated on the researcher's side of the booth for the remainder of the session.

Otoscopy was conducted to ensure that participants did not have excessive cerumen or drainage which may impact the test results. No participants presented with drainage or excessive cerumen and no medical referrals were necessary. Participants were given a response button and instructed to press the button each time they heard a tone. Participants were informed that tones would occur in series of three short tones. EAR-Tone 3A insert earphones were inserted into the participant's ear canal by the researcher. The researcher administered a hearing screening in which pulsed tones were presented at 20 dB HL at 250, 500, 1000, 2000, 3000, 4000, 6000, and 8000 Hz in the ear to be tested. One ear was tested for each participant, and the test ear was alternated between participants. Participants who were unable to pass the hearing screening were excluded from the study.

Once the participant passed the initial screening the researcher provided the participant with a scenario and directions to feign hearing loss in one ear (Appendix C). The researcher read the scenario and directions to the participant. The scenario and directions were also typed and given to the participant to reference throughout the test. The scenario outlined the compensatory motivation for malingering and described a situation in which the individual needed to feign hearing loss to be successful in a workers' compensation claim. Participants were instructed to respond to the test as though they were the individual described in the scenario. The researcher gave typical instructions for either the Hughson-Westlake or Bekesy tracking procedure. All participants were assessed using the Hughson-Westlake technique, the Bekesy tracking test with a pulsed tone, and the Bekesy tracking test with a continuous tone. The order of the tests was counter-balanced between participants. When the Hughson-Westlake procedure was used, the participant was given the following instructions:

You are about to hear a series of tones. The tones will be presented in groups of three to four. When you can hear a group of tones, press and release the button. You should only press once for each group. The tones will change in pitch and loudness throughout the test.

When the Bekesy procedure was used, the participant was given the following instructions:

You are about to hear a constant tone. The tone may be pulsed or steady. The tone will slowly get softer until you can no longer hear it. Press and hold the button as long as you can hear the tone. When you are no longer able to hear the tone, release the button. When you release the button the tone will slowly become louder. When

you can hear the tone again, press and hold the button. We will repeat these steps for several tones, each of which will have a different pitch.

Before each procedure, the participant was reminded to follow the test instructions while responding as though he or she was the individual described in the scenario.

During the Hughson-Westlake procedure, the researcher started with a 1000Hz pulsed tone at 30 dB HL and used the standard bracketing procedure to identify auditory threshold. The tone was decreased in 10 dB HL increments when the participant successfully responded and was increased in 5 dB HL increments when the participant failed to respond. Tones were presented in series of three to four pulses with at least one second between presentations. Threshold was defined as the lowest level of sound in which the participant could respond at least 50 percent of the time. The researcher tested frequencies between 250 and 8000 Hz in the following order: 1000 Hz, 2000 Hz, 3000 Hz, 4000 Hz, 6000 Hz, 8000 Hz, 1000 Hz, 500 Hz, 250 Hz. The 1000 Hz retest was used to ensure test-retest reliability.

When the Bekesy tracking procedure was used, the researcher presented either a continuous steady-state or a continuous pulsed tone with an initial intensity of 30 dB HL. Each participant completed the Bekesy tracking test twice so they experienced both conditions. During each test, the tone gradually ascended in intensity until the participant pressed the response button. Once the response button was pressed, the tone gradually decreased in intensity until the button was released. The audiometer automatically completed three reversals of ascending and descending tones at each frequency. Frequencies were tested in the same order as described in the Hughson-Westlake

procedure. The auditory threshold was identified by the computer-based audiometer and was the average response level of each reversal.

Following all malingered pure-tone tests, the researcher asked the participant to complete a speech reception threshold test (SRT) while continuing to respond per the scenario. The researcher gave typical instructions for speech reception threshold testing. The participant was instructed to listen to words that changed in intensity and to repeat the words as best as possible. The researcher used a recorded version of Spondee List A on the Madsen Astera audiometer. The participant was not familiarized with the word list prior to the test.

A final assessment was completed using the Hughson-Westlake procedure to determine the participant's genuine auditory thresholds. The participant was informed that the scenario was not needed for this assessment and the participant should answer honestly when the tone was audible. The participant was reinstructed with typical test directions. A pulsed tone was used and the procedure followed the typical Hughson-Westlake method described above. A full pure-tone audiogram was completed to identify the participant's genuine auditory thresholds at 250, 500, 1000, 2000, 3000, 4000, 6000, and 8000 Hz.

Throughout the testing process, an observer was present on the researcher's side of the sound booth. The observer watched the participant through the booth window and noted non-verbal behaviors demonstrated during each test. The observer used a checklist (Appendix D) to track the frequency of typical non-verbal and paralinguistic indicators of deception during each test. The observer was a graduate student volunteer from the

audiology program at the University of Northern Colorado. The same observer participated throughout the entire process.

Following the hearing tests, participants were given a short break before the interview, if needed. Participants were seated in a quiet and private room to answer interview questions. The observer was not present for the interview. The researcher asked questions orally and recorded the conversation via audio recording. The researcher utilized an interview guide (Appendix E) but asked follow-up questions as necessary. Interviews were completed in one session. A participant number was used to eliminate identifying information from the transcript. The number was also used to identify all copies of audiometric tests for each participant. Member checking was utilized to allow participants to review the interview transcript and make changes and additions at a later date. Participants received a copy of the transcript via email within one week of data collection. Participants were given an additional week to review the transcript and respond with changes, additions, or retractions. This process was explained to the participant at the start of the interview.

Statistical Analysis

Analysis of audiometric data began with the identification of common audiogram configurations, if present. Common configuration categories included flat, sloping, rising, trough, and corner audiograms. A sixth category was included for audiograms with an atypical configuration. Descriptive statistics, including relative frequency of occurrence, were used to determine the most common configuration present for the Bekesy tracking and Hughson-Westlake procedures.

The four-frequency pure-tone average (PTA) was calculated for all malingered Hughson-Westlake and Bekesy audiograms. The four-frequency PTA was the average threshold of 500, 1000, 2000, and 4000 Hz. Each PTA was labeled with the corresponding degree of hearing loss. PTA scores of 20 dB HL or less were classified as normal hearing. PTA scores of 21 to 40 dB HL were placed in the mild category. Scores of 41 to 55 dB HL were categorized as moderate. Scores of 56 to 70 dB HL were classified as moderately-severe. PTA scores of 71 to 80 dB HL were placed in the severe category. Since testing was not permitted to exceed 80 dB HL per the IRB requirements, it was not possible for participants to produce a PTA greater than 80 dB HL. Therefore, the profound category was excluded.

Once the four-frequency pure-tone averages were classified, a frequency table was developed to determine the relative frequency of each degree of hearing loss. Comparisons were made to identify the effect of test procedure (Hughson-Westlake vs. Bekesy tracking) and stimulus type (pulsed vs. continuous tone). Additionally, comparisons were made to the PTA degree of hearing loss produced by the experienced group and the inexperienced group to determine the effect of prior experience on malingered hearing test results.

Three-frequency PTA was also calculated for each malingered audiogram and for each genuine audiogram. The three-frequency PTA was calculated using the average of 500, 1000, and 2000 Hz. The malingered PTA values were compared to the malingered SRT score for each participant. A frequency table was generated indicating how frequently the SRT results occurred within 10 dB HL of the malingered PTA for the Bekesy tracking test and the Hughson-Westlake test.

Finally, observer checklists were sorted per the corresponding test (malingered Hughson-Westlake, malingered Bekesy with a pulsed tone, malingered Bekesy with a continuous tone, malingered SRT, and genuine thresholds). A frequency table was developed to indicate the frequency of occurrence for each behavior in each procedure. The frequency of these behaviors during the genuine threshold test was used as a baseline for comparison purposes.

Qualitative Data Analysis

After qualitative data are gathered, each item must be coded. Coding requires the researcher to assign a shorthand identifier so that the data can be easily retrieved and sorted. Codes can be numbers, letters, or colors. The codes are used to assign each item of data to a specific category. The categories are used to identify themes and trends within the data. Marshall and Rossman (2006) described the categories as “buckets or baskets into which segments of text are placed” (p. 159).

The categories used during qualitative data analysis must meet specific requirements to produce the most valuable comparisons throughout the data set. The categories should be responsive to the type of research. They should be relevant and need to help answer the research questions. Categories should also be exhaustive, meaning that each piece of data falls into one category. Similarly, the categories should be mutually exclusive so that each piece of data falls into only one category. The category titles must reflect the type of data that is included in the category so that themes and trends can be easily identified. Finally, the categories need to be conceptually congruent. This means that the same level of abstraction must exist across categories so that the data can be compared through the same lens (Merriam, 2009).

In this study, individual interview responses were transcribed from recordings after each data collection session. The responses to each question were aggregated and divided by participant group. Redundant quotes were removed and direct quotes were maintained whenever possible to include the greatest amount of insight and information. The responses to each question were then coded and sorted into categories to identify themes. The responses remained separated by participant group to compare statements made by members of each group. Comparisons were made to identify differences in test-taking strategy for the three main variables; participant experience, test procedure, and stimulus type.

Descriptive Statistics

In addition to qualitative analysis, this study also included analysis of quantitative data. The quantitative data were collected from audiograms performed throughout the data collection process and from data collected through observation of each participant. The data were analyzed using descriptive statistics including frequency and percentages. Descriptive statistics are inferential statistics meaning that the aim is to describe what the data says or shows (Altman, 1991).

Descriptive statistics are used to make an inference about a population using a set of data collected from a population sample. The data collected in this study was discrete numerical data because the data were made up of the count of specific event occurrences. For example, the data consisted of the count of specific audiogram configurations and the count of specific participant behaviors. These data were analyzed by identifying the frequency of occurrence for each event. The percentage of occurrence for each possible outcome was calculated to evaluate the relative frequency of that outcome to the entire

sample. Percentages are values which reflect the ratio of one quantity to another. This value contains meaning within large populations. However, in this study the frequency of occurrence for each event was also maintained to provide a more accurate representation of the data produced by this population sample (Altman, 1991).

Summary

Twenty participants were included in this study. Ten participants had experience with audiometric testing and ten participants were inexperienced with audiometric testing. Each participant was asked to complete three pure-tone tests and a speech reception threshold test while feigning a unilateral hearing loss. A final pure-tone test was completed to establish the participant's genuine thresholds. Each participant was monitored by an observer throughout the data collection process. The observer tracked the frequency of occurrence of non-verbal and paralinguistic indicators of deception during each test condition. Data gained from each of these portions of the data collection process were analyzed using descriptive statistics.

Each participant was also asked to participate in an interview session. The purpose of the interview was to identify strategies that each participant used to successfully feign hearing loss. The responses to interview questions were coded and sorted into themes to identify the most common strategies used by each participant group and for each test condition.

CHAPTER IV

RESULTS

Audiogram Configurations Identified On Malingered Hearing Assessment

The first research question to be answered was related to the frequency of typical audiogram configurations during malingered Hughson-Westlake and Bekesy tracking tests. It was hypothesized that malingerers will try to maintain consistency throughout the test which will likely result in flat audiograms most frequency.

The results of each malingered pure-tone hearing assessment (Bekesy pulsed tone, Bekesy continuous tone, Hughson-Westlake) were plotted on an audiogram for each participant and the configurations were noted. Possible configurations were flat, sloping, rising, trough, corner, and other. Audiograms were categorized based on the audiometric configurations defined by Roeser & Clark (2012). Audiograms were placed in the “other” category if there was greater than 20 dB difference in thresholds and the configuration didn’t clearly comply with one of the other categories. A greater variation in audiogram configurations was seen in the experienced group, but the flat configuration was most commonly seen in each condition. Sloping, rising and corner audiograms were not produced by any participant. Table 1 indicates the frequency of each audiogram configuration for each participant and for each test condition.

Table 1

Frequency of Typical Audiograms on Malingered Hearing Assessments

	Experienced Group				Inexperienced Group		
	Hughson- Westlake	Bekesy Pulsed	Bekesy Continuous		Hughson- Westlake	Bekesy Pulsed	Bekesy Continuous
Flat	9	8	8	Flat	10	10	9
Sloping	0	0	0	Sloping	0	0	0
Rising	0	0	0	Rising	0	0	0
Trough	1	1	2	Trough	0	0	0
Corner	0	0	0	Corner	0	0	0
Other	0	1	0	Other	0	0	1

Degree of Hearing Loss Indicated by Malingered Hearing Assessment

The second research question to be answered was related to the degree of hearing loss that is indicated by malingerers during the Hughson-Westlake and Bekesy tracking tests. It was hypothesized that some individuals may produce a greater degree of hearing loss with the Bekesy tracking test but others may produce a greater degree of hearing loss with the Hughson-Westlake test.

The degree of hearing loss indicated by individuals malinger during the Bekesy tracking and Hughson-Westlake hearing assessments varied greatly and ranged from normal hearing sensitivity to severe hearing loss. In general, the experienced group malingered so that a more significant hearing loss was indicated compared to the results of the inexperienced group. To assess the degree of malingered hearing loss, audiograms were plotted for each participant for the malingered Hughson-Westlake assessment and the malingered Bekesy tracking assessment with a pulsed tone. Audiograms were categorized as normal, mild, moderate, moderately-severe, or severe based on the four-frequency PTA. Table 2 provides a summary of the degree of hearing loss indicated on each assessment by participants from the experienced and inexperienced groups.

Table 2

Frequency of Degree of Hearing Loss Indicated on Malingered Hughson-Westlake and Bekesy Tracking Hearing Assessments

	Experienced Group			Inexperienced Group	
	Hughson- Westlake	Bekesy Pulsed Tone		Hughson- Westlake	Bekesy Pulsed Tone
Normal (≥ 20 dB HL)	0	0	Normal (≥ 20 dB HL)	1	1
Mild (21-40 dB HL)	2	2	Mild (21-40 dB HL)	6	6
Moderate (41-55 dB HL)	0	1	Moderate (41-55 dB HL)	1	1
Moderately- Severe (56-70 dB HL)	6	5	Moderately- Severe (56-70 dB HL)	1	1
Severe (71-90 dB HL)	2	2	Severe (71-90 dB HL)	1	1

In addition to evaluating the degree of hearing loss indicated by participants in each group, the four-frequency pure-tone average (PTA) was also calculated for each audiogram (Appendix F). The four-frequency PTA was calculated by averaging malingered thresholds at 500, 1000, 2000 and 4000 Hz. The four-frequency PTA for the experienced group ranged from 34 to 75 dB HL for the Bekesy tracking assessment with a pulsed tone and from 30 to 78 dB HL for the Hughson-Westlake hearing assessment. The four-frequency PTA was generally lower and more varied in the inexperienced group. The PTA of the inexperienced group ranged from 18 to 61 dB HL for the Bekesy tracking test and from 18 to 80 dB HL for the Hughson-Westlake assessment.

The four-frequency PTA was also calculated using each participant's non-malingered audiogram. These values were compared to the malingered PTA of each participant. The difference between malingered and genuine thresholds was compared for each participant to determine which group of participants produced malingered thresholds that were most different from his or her true thresholds. The average difference was calculated for each group and for each assessment (Figure 2).

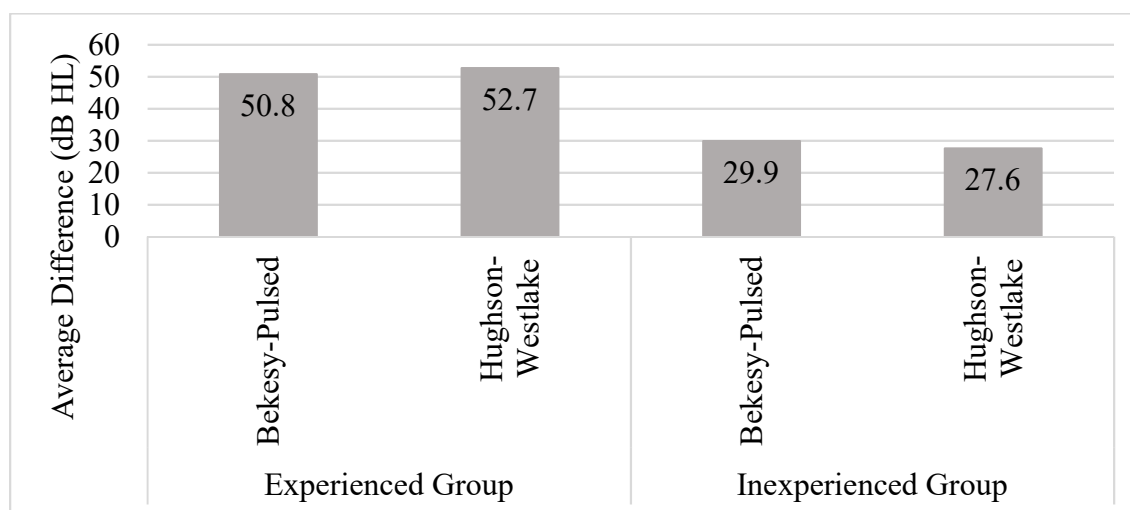


Figure 2. Average Difference Between Genuine and Malingered Four-Frequency PTA by Participant Experience

Effect of Pulsed and Continuous Tones on Degree of Malingered Hearing Loss

Malingered audiograms were also evaluated to identify the effect of stimulus type on degree of hearing loss. It was hypothesized that the data would be consistent with the Bekesy type V audiogram and that the pulsed tone would result in more hearing loss than the continuous tone.

Each participant completed the Bekesy tracking test twice to evaluate the effect of performing hearing assessments with pulsed tones compared to continuous tones. The

degree of hearing loss indicated by individuals malingering during the Bekesy tracking test with a pulsed tone and the Bekesy tracking test with a continuous tone ranged from normal hearing sensitivity to a severe hearing loss. As was seen in the comparison of Hughson-Westlake to the Bekesy tracking test, the experienced group tended to produce audiograms indicative of more significant hearing losses compared to the audiograms produced by the inexperienced group. To assess the degree of malingered hearing loss present in each condition, audiograms were plotted for each participant for the malingered Bekesy tracking assessment with a pulsed tone and for the malingered Bekesy tracking assessment with a continuous tone. The PTA was calculated for each audiogram and categorized based on degree of hearing loss. The number of participants who produced Bekesy type V audiograms was also tallied. Twelve participants produced results which are consistent with the Bekesy type V audiogram. Seven of the twelve participants were in the experienced group. This indicates that the conclusion that a continuous tone will produce less hearing loss than a pulsed tone was supported by this study. However, the difference in malingered PTA with a pulsed and continuous tone was very slight. The degree of hearing loss categorizations was not affected by the difference in PTA which indicates that, overall, stimuli type did not affect the degree of hearing loss on malingered assessments. Figure 3 illustrates the degree of hearing loss indicated on each version of the Bekesy tracking test by participants from the experienced and inexperienced groups.

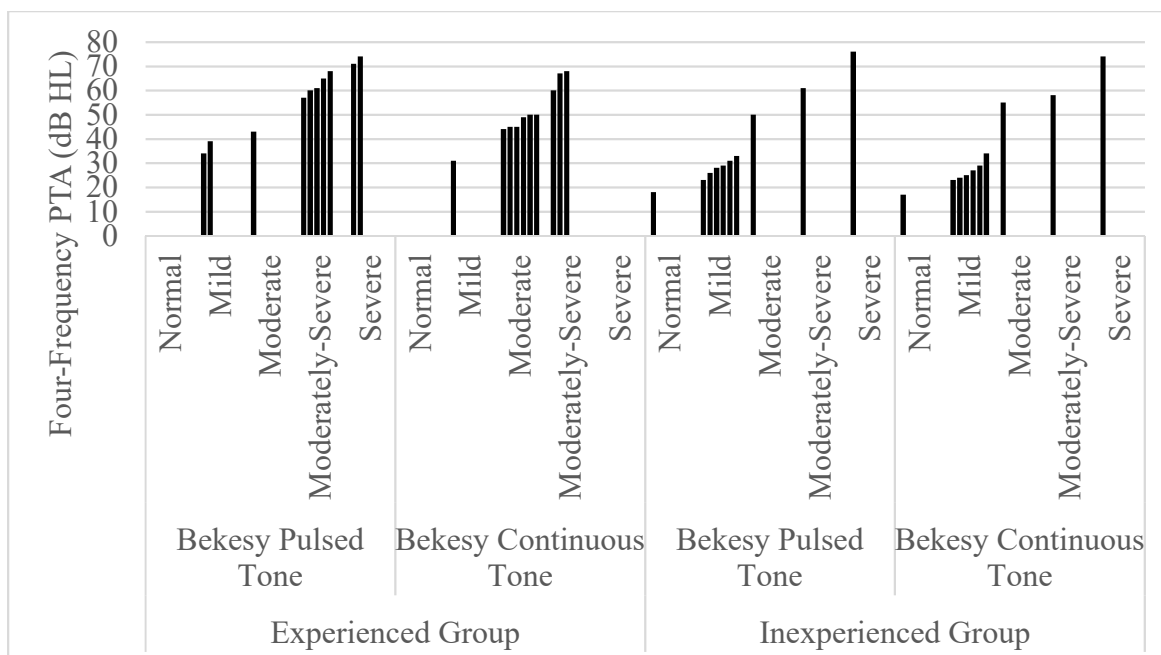


Figure 3. Frequency of Degree of Hearing Loss Indicated with Pulsed and Continuous Tones on the Bekesy Tracking Test.

In addition to comparing the degree of hearing loss indicated on audiograms from each group, the four-frequency pure-tone average (PTA) was calculated using the average threshold at 500, 1000, 2000 and 4000 Hz. The four-frequency PTA for the Bekesy tracking test with a pulsed tone ranged from 34 to 74 dB HL for the experienced group and from 18 to 61 dB HL for the inexperienced group. The four-frequency PTA for the Bekesy tracking test with a continuous tone ranged from 31 to 68 dB HL for the experienced group and from 17 to 58 dB HL for the inexperienced group.

To compare the malingered hearing loss to true thresholds for each participant, the four-frequency PTA was also calculated using each participant's non-malingered audiogram. Each participant's genuine four-frequency PTA was compared to their malingered PTA from the Bekesy tracking test with pulsed and continuous tones. The average difference was calculated for each group and for each test condition (Figure 4).

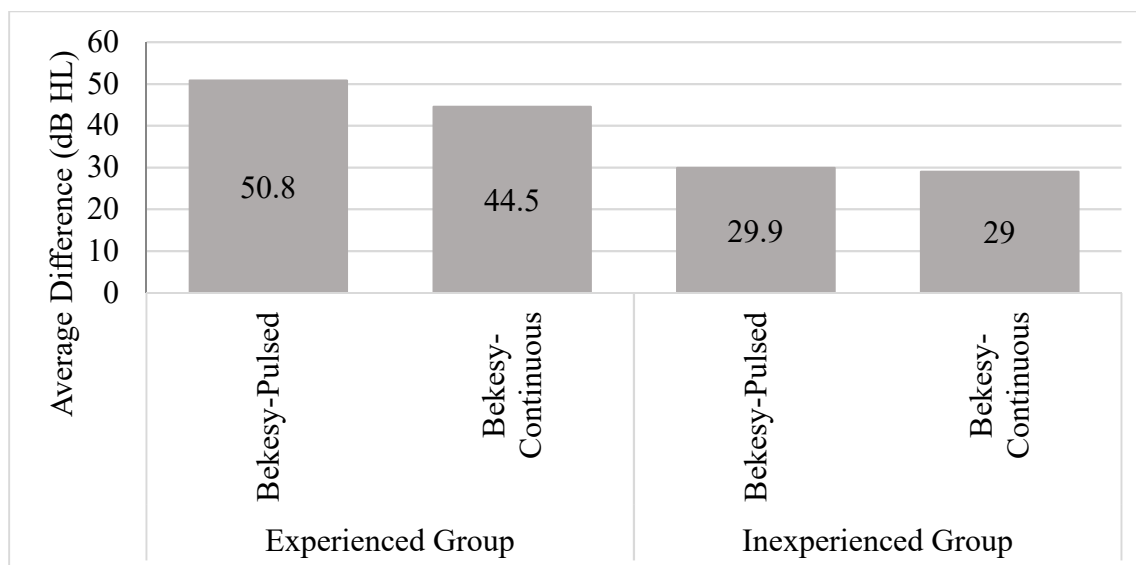


Figure 4. Average Difference Between Genuine and Malingered Four-Frequency Pure-Tone Average on the Bekesy Tracking Test with Pulsed and Continuous Tones.

Comparison of Malingered Pure-Tone Average to Malingered Speech Reception Threshold

Malingered speech reception threshold (SRT) testing was conducted to compare the frequency of agreement between malingered SRT and malingered PTA during the Hughson-Westlake and Bekesy tracking tests. It was hypothesized that experienced malingerers are likely to be more consistent than inexperienced malingerers but that achieving consistency between these values is unlikely overall due to perceptual differences between speech and tones.

Cross-checks between assessments in a test battery are used to confirm the validity of results during hearing assessment. A frequently used cross-check is the comparison between the speech reception threshold (SRT) and the pure-tone average (PTA). Generally, the SRT and three-frequency PTA agree with one another when they differ by 10 dB HL or less.

The three-frequency PTA was calculated for each participant for the malingered Bekesy tracking test with a pulsed tone, malingered Bekesy tracking test with a continuous tone, malingered Hughson-Westlake test and the non-malingered assessment. Each participant was also asked to complete the SRT assessment while malingering per the hearing loss described in the scenario. The malingered PTA for each assessment was compared to the malingered SRT to determine whether they agreed with one another. Malingered SRTs for the experienced group ranged from 30 to 65 dB HL. Malingered SRTs for the inexperienced group ranged from 10 to 55 dB HL. Figure 5 summarizes the number of instances in which the three-frequency PTA and the malingered SRT were consistent (fell within 10 dB HL of one another). Generally, the experienced group more consistently produced PTAs and SRTs which agreed within 10 dB of one another. However, the test procedure used did not have had a significant effect on the rate of PTA and SRT agreement.

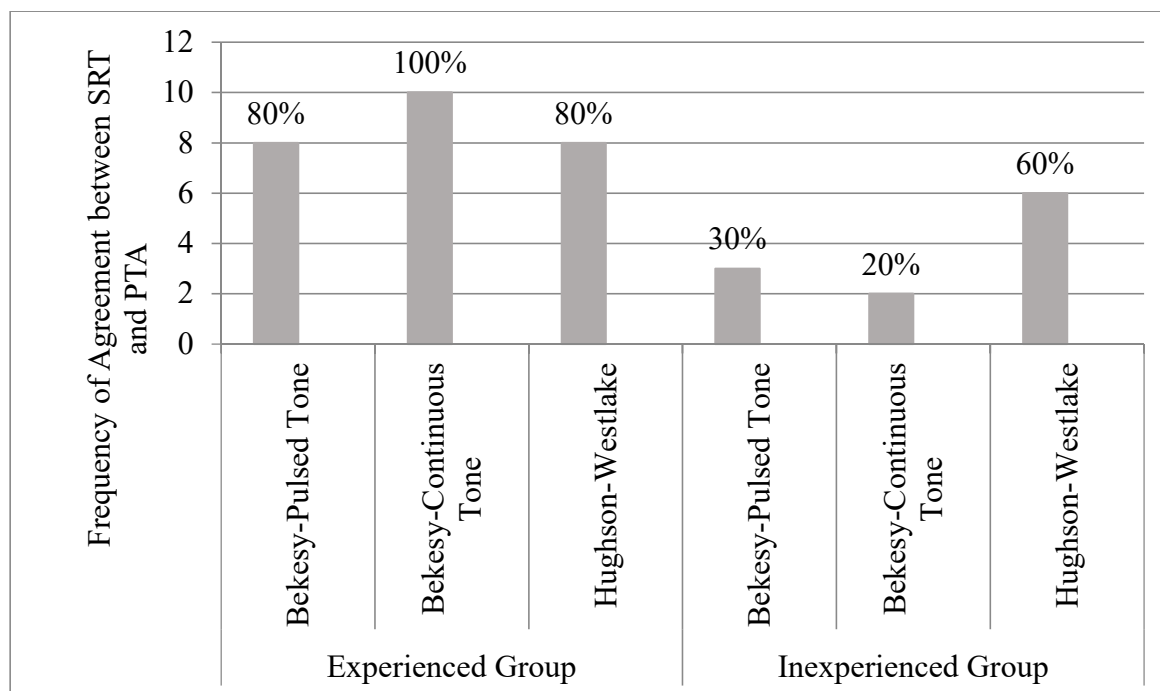


Figure 5. Frequency of Agreement Between Malingered PTA and Malingered SRT.

Malingering Strategies Used During Hughson-Westlake and Bekesy Tracking Assessments

Interview data were evaluated to identify strategies used by malingerers when feigning hearing loss. Strategies were compared to identify differences between the Bekesy tracking test and the Hughson-Westlake test. Strategies were also compared to identify differences between participants who have experience with audiometric testing and participants who do not have experience with audiometric testing. It was hypothesized that loudness memory is likely to be a common strategy during the Hughson-Westlake test because the stimuli are presented in discrete intervals. Additionally, it was hypothesized that timing intervals would most likely be used during the Bekesy tracking test because the stimuli change gradually over time. It was expected that participants in the experienced group would rely on their previous knowledge to

develop strategies and inexperienced participants will create arbitrary rules to follow to maintain consistency throughout the test.

General Strategies

Participants in this study used a variety of strategies while feigning hearing loss. Participants explained that they used strategies which they felt were likely to be effective when feigning hearing loss. Participants were asked if they believed they had been successful at the task and which strategies they used to feign hearing loss. The strategies used varied between individuals and were often based on previous knowledge of hearing assessment if the participant had prior experience. Nearly all participants reported that the strategy chosen resulted in complete or partial success in the task. Eleven participants (55%) believed that they were completely successful at feigning hearing loss. Six of these participants had prior experience with hearing assessment. Seven participants (35%) expressed that they were partially successful at feigning hearing loss. Of these individuals, four had previous experience with hearing assessment. Two participants (10%) believed that they were unsuccessful at feigning hearing loss. Both participants were from the group without prior experience and knowledge of hearing assessment.

Participants who stated that they were successful at feigning hearing loss often had this opinion because they completed the assessment with a strategy in place. Participants who did not have prior experience stated that they quickly gained experience with the task and that they became successful after brief trial and error. One participant stated, "When I first started it was hard because I was trying to find the pattern to make it seem like I had hearing loss. Once I found the pattern it became easier." Some participants were confused by which sounds they should be able to hear based on the

scenario and relied primarily on guesswork. A participant from the group without prior experience stated, “I wasn’t sure if I was supposed to be able to hear more when [the tones] were higher or lower. I just had to guess when to respond but I think I was pretty successful.” Participants with prior hearing assessment experience stated that they were successful because they could accurately maintain a loudness memory throughout the procedure. In some instances, these participants expressed that the strategy chosen had helped them to respond consistently enough to show hearing loss but they were unsure of whether they had produced a hearing loss that was consistent with the case described in the scenario.

Bekesy Tracking Strategies

Of all the strategies described to complete the Bekesy tracking test, four strategies stood out as the most frequently used. The most used strategy was selecting an interval of time and maintaining a consistent interval between responses. Two participants described holding the button and letting the tone descend for four seconds and then releasing and allowing the tone ascend for another four seconds. Another participant described the same strategy but stated that they had used intervals of three seconds and seven to ten seconds. Most participants who used this strategy for the Bekesy tracking test were from the participant group without previous hearing assessment experience.

The other strategy used most by participants from the group without previous experience was never described by participants from the experienced group. This strategy was to base their response on a subjective comparison between the loudness of the tone presented and their true threshold. One participant stated that he waited until the sound was just a little louder than the softest sound he could hear before responding. Another

participant stated, “I thought about the softest sound I could really hear and then tried to double the loudness. I pretended like that level was really the softest sound I could hear.” A third participant described pressing the button as soon as possible and being cautious to release the button while the tone was still audible.

The primary strategy used by individuals from the experienced group was the maintenance of an internal loudness memory. This strategy was not described by any participants from the inexperienced group. Participants who used this strategy described trying to remember the loudness each time they responded and match the same loudness level for each frequency. The participants were unable to describe why they chose the level that was selected and stated that the chosen loudness level seemed “appropriate.” In addition to this strategy, members of the experienced group also used a counting strategy for pulsed tones. They described counting the pulses to maintain consistent intervals for each excursion of the Bekesy tracking test. One participant said, “I would count the pulses as they were presented for each frequency. I would press the button after I felt like enough pulses had passed and the sound was likely to be loud enough for a person with hearing loss to respond. Then I would count the pulses as they ascended and descended to be sure that my responses stayed consistent.”

Other strategies for the Bekesy tracking test which were used less frequently were waiting for a perceptible change in the stimuli, making a comparison between the stimuli and typical conversation level, and trying to respond approximately 50 percent of the time. An experienced participant who relied on a perceptible change in the stimuli said, “I was waiting until the sounds were loud enough to hear a distortion in the signal.” Another experienced participant said she waited for a noticeable change in the loudness before

pressing or releasing the button. Participants who used the strategy requiring a comparison between the stimuli and typical conversation were both in the experienced group. One participant described that a “fifty percent” hearing loss seemed likely to result in thresholds that were similar to the intensity level of typical conversation. This participant described waiting until the stimuli seemed to be equal in loudness to typical conversation before choosing to respond. Finally, a participant from the inexperienced group stated that he was unsure how to respond and chose to spend 50 percent of the time with the button depressed and 50 percent of the time with the button released.

Strategies for Hughson-Westlake

Strategies for malingering during hearing assessment using the Hughson-Westlake technique varied greatly between participant groups. The strategies that were most frequently used by the inexperienced group were the use of a pattern to dictate responses and a subjective comparison between the tone and the participants’ true threshold. The strategies used most frequently by the experienced group were the maintenance of internal loudness memory and estimating the intensity level of the stimuli based on knowledge of the Hughson-Westlake procedure.

Participants in the inexperienced group who chose to use a pattern to dictate responses each chose a different pattern which felt appropriate to the individual. One participant alternated between responding and not responding. Another participant chose only to respond for every fourth presentation. The participants stated that there did not seem to be a best pattern but that the use of a pattern would make results more consistent and convincing. Participants who chose to compare the stimuli to his or her own threshold described strategies which were similar to those used for the Bekesy tracking

test. One participant tried to find a loudness level which was “double” his true threshold. Another participant stated that she waited until the sound was just a little louder than [she] could really hear and then pressed the button.”

Another strategy that was consistent with those used on the Bekesy tracking test was the maintenance of an internal loudness memory. This strategy was used most by members of the experienced group but was also used less frequently by members of the inexperienced group. One participant from the experienced group said, “I just tried to keep a level in my head, remember and come back to it.” The other strategy used frequently by participants in the experienced group was keeping track of presentations and estimating the intensity level of each stimulus based on knowledge of the Hughson-Westlake procedure. This strategy was never used by participants from the inexperienced group. One participant who chose this strategy stated, “I just counted. Would respond four presentations louder than wherever you started. Then I would skip two because you had to go down 10 dB and ascend back up. Then I would respond again.”

Two other strategies were used less frequently than the others and were only used by participants of the experienced group. The first strategy was the comparison of the stimuli to soft, average, and loud sounds. One participant stated that she “tried to compare a normal sound to a loud sound but didn’t want to go too loud so she began responding before the tone was overwhelming. The other strategy was to rely on vibro-tactile information to decide whether to respond. This strategy was used by one participant who said, “I judged my response based on how [the tone] felt rather than how loud it was.” This participant attempted to respond consistently by only responding when she could perceive the vibro-tactile input from the earphone.

Non-Verbal and Paralinguistic Responses During Malingered Hearing Assessment

The final research question was related to the difference in type and number of non-verbal and paralinguistic responses when malingering during the Hughson-Westlake and Bekesy tracking tests. It was hypothesized that malingerers would display more of these behaviors during the test they feel is most difficult and that the type of behavior is most likely to vary based on the individual rather than the procedure.

When an individual attempts to feign hearing loss, indicators that the loss is illegitimate are often present apart from the audiogram. Non-verbal and paralinguistic responses were evaluated for each participant to assess response patterns that were present during malingered assessments compared to the non-malingered assessment. The responses that were evaluated were increased use of filler phrases, changes in vocal pitch, increased time between phrases, avoidance of eye contact, slowed rate of speech, shifting of the body, increased movement of the hands, fingers or feet, decreased movement of the hands, fingers or feet, and increased self-touches. These responses were evaluated by an observer who monitored and charted the frequency of each behavior during each test condition. The same observer monitored each participant. The frequency of each behavior was totaled for the experienced and inexperienced groups for each test condition. Upon further consideration, the increased use of filler phrases, changes in vocal pitch, increased time between phrases, and slowed rate of speech categories were combined and renamed “Hesitancy of Speech Responses/Change in Vocal Confidence.” It was determined that this title is a more accurate representation of vocal disturbances that were present during malingered hearing testing.

The test conditions evaluated were the malingered Hughson-Westlake, malingered Bekesy tracking test with a pulsed tone, malingered Bekesy tracking test with a continuous tone, malingered SRT, and non-malingered assessment. The most frequently performed behavior was decreased movement of the hands, fingers or feet with a total of 126 occurrences. The least performed behavior was increased movement of the hands, fingers or feet with a total of four occurrences. Figure 6 illustrates the frequency of each occurrence of each behavior during each test condition.

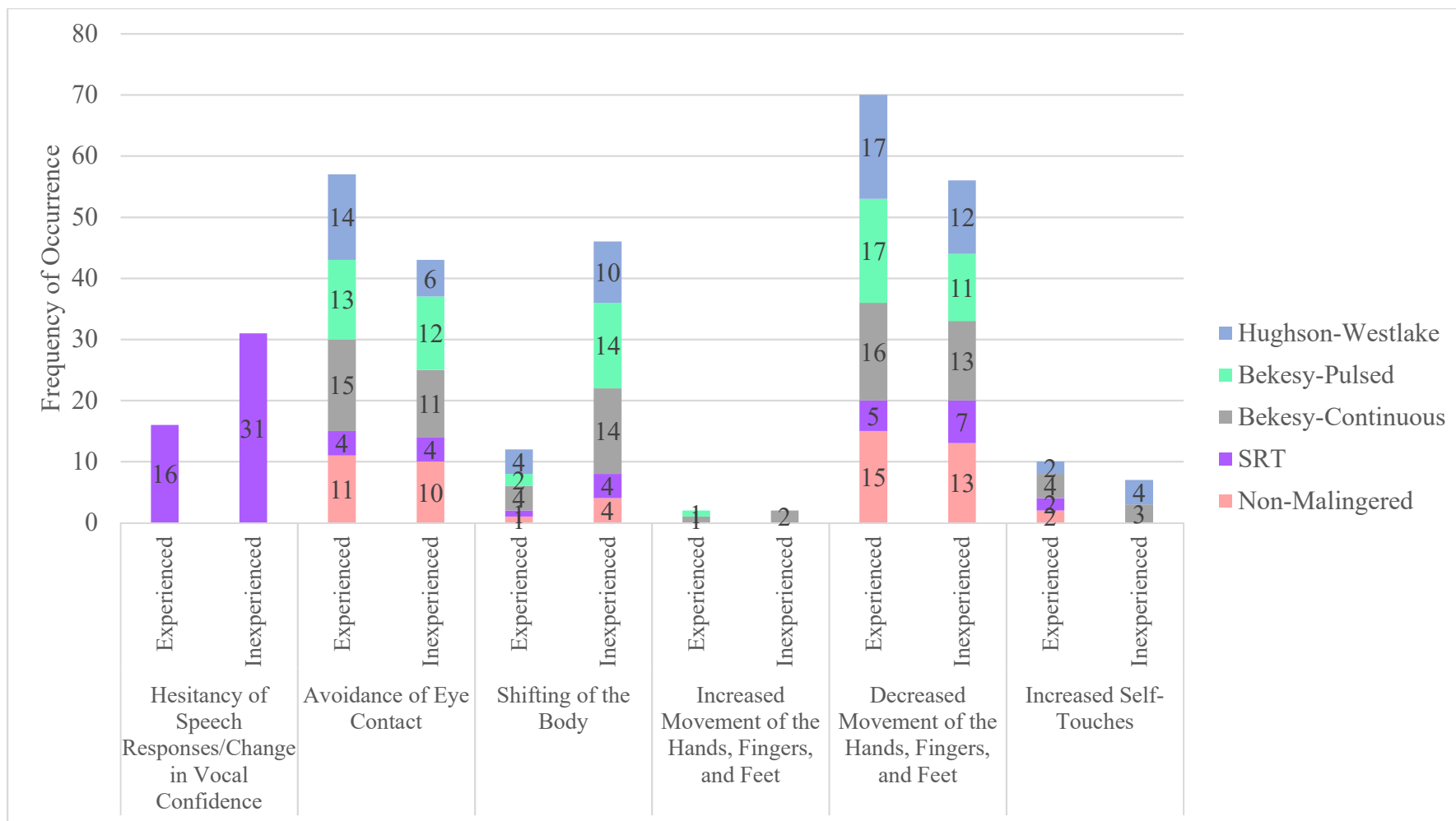


Figure 6. Frequency of Non-Verbal and Paralinguistic Behaviors during Malingered and Non-Malingered Hearing Evaluation

Summary

The data analysis process indicated that the flat audiogram configuration occurred most frequently regardless of participant experience, test procedure or stimuli type. Participant experience appears to have a role in the degree of malingered hearing loss. Experienced participants consistently produced audiograms showing more hearing loss than the inexperienced group. However, test procedure and stimulus type appear to have no effect on degree of hearing loss. Overall, the experienced group was also capable of producing greater consistency between malingered PTA and SRT. The most common strategies used during the Bekesy tracking test were the maintenance of consistent time intervals, comparison of the stimuli to genuine thresholds, and loudness memory. The most common strategies used during the Hughson-Westlake test were the use of patterns to determine responses, comparison of the stimuli to genuine thresholds, and loudness memory. Experienced malingerers did tend to rely on prior knowledge to develop strategies. Inexperienced malingerers developed arbitrary rules to follow to maintain consistency but also felt that brief trial and error while testing allowed them to gain experience and develop strategies. The most common behavior observed was decreased movement of the hands, fingers, and feet. Participants generally avoided behaviors that might draw unnecessary attention onto themselves.

CHAPTER V

DISCUSSION

The purpose of this study was to identify the strategies and response patterns which are present in a hearing evaluation when an individual attempts to feign hearing loss. Additionally, this study was also conducted to identify the frequency of typical audiometric configurations and the effect of experience on the successful feigning of hearing loss. The effect of test procedure and stimulus type was evaluated as was the relationships between malingered pure-tone and speech responses. Common non-verbal or paralinguistic responses which may be observed during hearing assessment with a malingering patient were monitored and evaluated.

Malingering is the intentional response to a hearing test to indicate “a deficit greater than can be explained by organic pathology” (Austen & Lynch, 2004). As was previously discussed, it is important to understand the strategies used and the common response patterns of malingerers because the incidence of these situations is estimated to occur in 20 to 50 percent of medico-legal cases (Poole, 2010).

Malingered Audiogram Configuration

The first question posed in this study related to the frequency of occurrence of typical audiogram configurations during malingered hearing assessment. It was hypothesized that most participants would produce flat audiograms as this is the most typical configuration produced by malingerers (Chaiklin, Ventry, Barrett & Skalbeck,

1959) but that experienced malingerers may produce sloping configurations due to the frequency of sloping hearing loss seen in clinical practice. The research from Chaiklin et al. (1959) was supported by this study as flat configurations were presented in 90 percent of malingered pure-tone assessments. Contrary to the hypothesis, sloping audiogram configurations were not present in any malingered pure-tone assessments. Given this information, it is important that clinicians confirm the validity of flat audiograms, particularly if motivation for feigned hearing loss is present. Clinicians should ensure that there is consistency across the test battery and that the audiogram configuration is consistent with the patient's description of the nature and onset of the hearing loss. Additionally, when presented with a flat, unilateral hearing loss, clinicians should ensure the use of adequate contralateral masking. Flat configurations may occur because of crossover if the non-test ear has a flat configuration with normal hearing sensitivity.

Degree of Hearing Loss on Malingered Assessments

The second research question posed in this study was related to the degree of hearing loss indicated on malingered hearing assessments and the effect of test procedure. Similarly, the third research question was related to the degree of malingered hearing loss and the effect of stimuli type.

Throughout this study the difference between the degree of hearing loss indicated on malingered assessments was evaluated. The degree of hearing loss was compared to identify differences between Hughson-Westlake and the Bekesy tracking test. Comparisons were also completed between tests completed with pulsed and continuous tones and between participants with and without audiometric testing experience.

When comparing the degree of hearing loss that is indicated on malingered Hughson-Westlake and Bekesy tracking tests, it was hypothesized that Hughson-Westlake would produce a more severe degree of hearing loss because changes in stimulus intensity occur in larger, discrete steps. It was found that the test procedure had very little impact on the degree of malingered hearing loss. Inexperienced participants had the same distribution of degree of hearing loss on both test procedures. The experienced group had nearly the same distribution between tests except for the participant who fell in the moderately-severe range on the Hughson-Westlake test but decreased the severity to the moderate range during the Bekesy tracking test. These results indicate that the test procedure does not have a large impact on degree of hearing loss regardless of participant group.

These data were also analyzed by comparing the malingered four-frequency PTA to the participant's true PTA. A significantly greater difference was shown between malingered and genuine PTAs for the inexperienced group than for the experienced group. However, each group remained consistent despite the test procedure used.

Although test procedure does not appear to have a great effect, experience with test procedures does appear to impact the degree of malingered hearing loss. Research by Erdal (2002) indicates that the most flagrant malingering occurs when the individual is motivated by personal gain. However, the greater difference between true and malingered thresholds for experienced participants indicates that the most flagrant malingering may also occur when the individual has prior experience and can more confidently select a successful malingering strategy. Inexperienced malingerers appear to be less likely to produce a hearing loss with more severity. In these instances, the individuals may be

concerned about being caught or may have difficulty understanding the test procedures. It is also possible that this difference is due to an over-confidence of experienced individuals.

When comparing the degree of malingered hearing loss produced by assessments completed with pulsed and continuous tones, it was hypothesized that continuous tones would produce less loss than pulsed tones. This hypothesis was based on previous research of the Bekesy Type V audiogram which was indicative of functional hearing loss. Prior research indicates that continuous tones are more challenging to hear and should result in identical thresholds or in more hearing loss than pulsed tones for genuine hearing loss. However, this effect is reversed for malingered losses and continuous tones frequently produce less hearing loss (Jerger & Herer, 1961; Peterson, 1963; Resnick & Burke, 1962; Rintelmann & Harford, 1963).

The results of this study indicate that stimulus type had little effect with the inexperienced group. Mild hearing losses were produced most consistently despite the type of tone that was used. However, the predicted result held true with the experienced group. The experienced group produced more moderate hearing losses with continuous tones and more moderately-severe losses when they were tested with pulsed tones. The experienced group also produced two severe hearing losses when tested with pulsed tones and did not produce any severe losses when tested with continuous tones.

The audiograms of each participant were also compared to identify how many participants produced results that are consistent with the expected Bekesy type V audiogram. Overall, the results of this study support the Bekesy type V audiogram. The continuous tones did produce less hearing loss than pulsed tones in most instances.

However, the difference between malingered PTA with a pulsed and continuous tone was very slight and the overall degree of hearing loss was not effected by stimuli type.

Based on this information, it is beneficial for clinicians to vary the type of stimuli used when the results of an evaluation are questionable. Clinicians should look for a change between pulsed and continuous tones and should investigate further if continuous tones produce less hearing loss.

Malingered Speech Reception Thresholds

The fourth research question related to the consistency between malingered SRT and PTA. Therefore, another aim of this study was to evaluate the agreement between malingered speech reception thresholds (SRT) and malingered three-frequency pure-tone averages (PTA). Jerger and Jerger (1981) stated that SRT is typically significantly better than PTA during malingered assessment. The results of this study supported the findings of Jerger and Jerger (1981). In this study 86.67 percent of trials produced a PTA which showed more hearing loss than the SRT produced by the same individual. Only 13.33% of trials (10% experienced group, 3.33% inexperienced group) resulted in an SRT which indicated more hearing loss than the PTA indicated by the same participant. In two trials (experienced group), the participant could match the SRT and PTA exactly. This occurred once during the Bekesy tracking with a pulsed tone and once during the Hughson-Westlake. The findings of Jerger & Jerger (1981) were supported consistently regardless of test condition or stimulus type. Malingered SRT consistently indicated less hearing loss than PTA for the Bekesy pulsed tone, Bekesy continuous tone, and Hughson-Westlake test conditions.

Comparison of Malingering Strategies Used During Hughson-Westlake and Bekesy Tracking Assessments

The fifth research question aimed to identify strategies used by malingerers during the Hughson-Westlake and Bekesy tracking tests. The sixth question sought to evaluate strategies further by comparing strategies used by experienced and inexperienced participants.

Participants in this study used a variety of strategies to feign hearing loss. There were some similarities and some differences between the strategies used on the hearing assessments when they were performed using the Hughson-Westlake and Bekesy tracking procedures. Most participants (90%) stated that their chosen strategy resulted in complete or partial success at feigning hearing loss.

The three most frequently used strategies during the Bekesy tracking test were the selection and maintenance of a consistent interval between responses, the comparison of the loudness of the stimuli to the individual's true threshold, and the maintenance of an internal loudness memory. Similarly, the comparison of the stimuli and true threshold and the maintenance of a loudness memory were also among the top strategies used for the Hughson-Westlake assessment. The other most frequently used strategy on the Hughson-Westlake assessment was the use of a pattern to dictate responses and the prediction of the intensity of each stimuli based on prior knowledge of the Hughson-Westlake procedure. The strategy of using a pattern to dictate responses is like the interval strategy used on the Bekesy tracking test. These strategies are similar because in all instances the participants created a rule for themselves which they believed would be most likely to be successful. The participants followed their rule to improve the consistency of their

responses even though the rules were arbitrary and not based on an understanding of hearing loss or test procedures. However, during the Hughson-Westlake test this strategy presented itself slightly differently as the participants chose to use a pattern of responses and no responses rather than maintaining one consistent interval.

Durlach and Braida (1969) identified loudness memory as the most common strategy used by malingerers. Loudness memory is the establishment of a mental gauge for the loudness of stimuli. Malingerers are required to compare each successive stimuli with the memory of the loudness of the original stimulus. They will respond to all stimuli that are perceived as louder than the original and will not respond to stimuli that are perceived to be softer. The maintenance of a loudness memory to determine how to respond was reported by participants as strategies they found helpful during both the Hughson-Westlake and Bekesy tracking tests. This strategy was only used by experienced participants during the Bekesy tracking tests but was used by participants from both groups during the Hughson-Westlake test. Often, participants from the inexperienced group reported that it was difficult to identify changes in frequency during the Bekesy tracking test because the tone changed gradually. This may indicate that malingerers may rely more heavily on loudness memory when they are tested in larger, discrete intensity increments. This may also indicate that malingerers who are more familiar with test procedures are more competent at maintaining a loudness memory because they can rely on their understanding of the procedure to estimate the intensity of the stimuli. In addition, malingerers using loudness memory choose their “threshold” based on which level feels appropriate. Based on the results of this study, malingerers with more experience are more likely to choose threshold levels of higher intensity than

inexperienced malingerers. These factors may indicate that it is important to deviate from typical test procedures when evaluating a potential malingerer; particularly if the individual has undergone hearing assessments in the past. However, Rintelmann and Carhart (1964) stated that it is difficult for all malingerers to maintain a loudness memory as the tone changes. This likely means that most malingerers must utilize additional strategies and clinicians should be aware that more than one strategy may be in use during a single assessment.

Based on the strategies described by participants from both groups, it is recommended that clinicians maintain awareness that loudness memory is not the only strategy used by malingerers. Clinicians should also understand other commonly used strategies. The degree of hearing loss indicated is subjective and varies based on what feels appropriate to the malingerer. Additionally, similarities in strategies exist but strategies are adapted slightly to fit the specific task and the goals of the malingerer.

Effect of Experience with Audiometric Testing on Malingering Strategies

Two participant groups were assessed to evaluate the effect of experience on malingering strategies during audiometric testing. One group had prior knowledge and experience with audiometric testing. The other group of participants had no knowledge or experience with the test procedures. It was hypothesized that the experienced group of participants will incorporate their prior knowledge when developing malingering strategies. This is significant because many malingerers have participated in audiometric assessment multiple times. They may also have researched hearing loss and the diagnostic procedures to be more successful (Rees & Tombaugh, 1998).

In this study, inexperienced participants tended to select and maintain an interval of time between responses. This strategy was adapted for pulsed tones by selecting an interval based on the number of pulses presented and maintaining the same interval throughout the process. The inexperienced participants also tended to compare their perception of the loudness of each stimuli to the softest level of sound they know they can hear. Participants waited until the sound “doubled” or was “just a little louder” than they could hear. In all instances, participants in the inexperienced group selected rules for themselves without the use of prior knowledge to justify why the chosen rule was most likely to be successful.

Conversely, participants in the experienced group often incorporated prior knowledge and experience as a justification for the strategies they used. Participants in this group relied on loudness memory more frequently and explained that their experience with audiometric testing allowed them to more easily perceive differences in “soft” versus “loud” sounds. Participants in the experienced group also used their knowledge of the Hughson-Westlake procedures to estimate the intensity level of each stimuli as the tones ascended and descended. In general, malingerers in the experienced group were more confident that their strategies were successful and used strategies that were based on knowledge of audiometric assessment.

Given that experienced malingerers rely heavily on their experience when feigning hearing loss, it may be necessary for clinicians to increase their awareness of other clinical indicators of exaggerated hearing loss when working with patients who have extensive experience with test procures. The referral source is a key indicator of potential malingerers. Thirty percent of patients who feign a disorder are referred for

personal injury cases from a plaintiff's attorney, doctor, defense attorney, or insurance company. Thirty two percent are referred due to a disability or worker's compensation disputes and 23 percent are referred by an attorney as part of a criminal investigation (Mittenberg, Patton, Canyock & Condit, 2002). Other clinical indicators to be noted are excessive nervousness, speaking in an unusually loud voice, frequent references to hearing loss, exaggerated attempts at lip reading, and a poor hearing evaluation despite a lack of difficulty communicating in casual conversation (Jerger & Jerger, 1981). It is recommended that clinicians increase their awareness of other clinical indicators of feigned hearing loss through a thorough record review and through observing patient behaviors that indicate they may have experienced a similar assessment elsewhere. It is also important to vary test conditions for patients who have been tested multiple times to prevent patients from relying on a known pattern if they choose to feign or exaggerate hearing loss. Techniques for varying the conditions may be using different test procedures, different stimuli types, or by varying the order of assessments within a test battery.

Presence of Non-Verbal and Paralinguistic Indicators of Deception in Malingered Hearing Assessment

The final research question related to the frequency of deception behaviors throughout each test condition. Non-verbal and paralinguistic indicators of deception are often observable in clinical practice but are not frequently documented (DePaulo, 1992) during clinical evaluations. During this study, an observer participated in the data collection process to monitor the number of instances in which each participant exhibited non-verbal or paralinguistic indicators of deception. The behaviors were tallied using a

checklist of some of the most common non-verbal and paralinguistic indicators of deception. The behaviors chosen were based on psychological research and included increase use of filler phrases, change in vocal pitch, increased time between phrases, avoidance of eye contact, slowed rate of speech, shifting of the body, increased movement of the hands, fingers, or feet, decreased movement of the hands, fingers, or feet, and increased self-touches (DePaulo, 1992; DePaulo et al., 1985; Ekman, 1989; Zuckerman & Driver, 1958; Zuckerman et al., 1981).

In this study, the most commonly observed behaviors were decreased movement of the hands, fingers, and feet, avoidance of eye contact, and shifting of the body. Avoidance of eye contact and decreased movement of the hands, fingers and feet were seen approximately equally in the malingered pure-tone tests and the non-malingered test. However, these behaviors were seen much less frequently in the malingered SRT situation. Shifting of the body occurred more frequently in the malingered situations than in the non-malingered situation. Additionally, several behaviors (increased use of filler phrases, change in vocal pitch, increased time between phrases, and slowed rate of speech) were only seen in the malingered SRT trials as participants were not given an opportunity to speak and exhibit these behaviors in the other test situations.

Many participants described behaviors like avoidance of eye contact and decreased movement during their interviews. Participants explained that they felt as though they would be more successful if they could dissuade the examiner from watching them too closely. Many participants stated that the best way to accomplish this was to remain as still as possible and to avoid making eye contact. This indicates that it is

important for clinicians to be aware of the common behaviors of malingerers and to pay attention to subtle behaviors throughout the testing process.

Study Limitations

The primary limitation of this study is related to the malingering-simulation paradox (Rogers & Cavanaugh, 1983). This theory states that individuals who are asked to mangle during a research study lack the intrinsic motivation that is present in true malingeringers whose lives will be directly impacted based on their ability to feign a disorder. Therefore, it is impossible to perfectly simulate genuine motivation so simulated malingeringers are often less skilled at malingering. In this study, the participants were asked to place themselves in the mindset of a true malingeringer but it is not possible to perfectly re-create the motivation and skill of a genuine malingeringer.

Another limitation of this study was the absence of contralateral masking. Often participants allowed the test stimuli to reach an intensity level which exceeded the interaural attenuation for the transducer used. Contralateral masking would have ensured that the non-test ear could not perceive the tone and respond. The use of contralateral masking is a standard procedure in clinical practice. It is possible that the high incidence of flat audiogram configurations seen in this study is related to the absence of contralateral masking. If contralateral masking were used it is possible that the malingeringed audiograms would result in a greater variety of audiometric configurations.

A third limitation of this study is a lack of consideration of testing strategies used by clinicians. When presented with a potential malingeringer, most clinicians will vary the test procedure to prevent the malingeringer from being able to maintain a consistent strategy. Clinicians might deviate from the typical bracketing procedure, for example, and choose

to ascend or descend instead. They may also alternate ears or vary the typical order of frequencies while testing to further challenge the malingerer.

Future Research

In describing the malingering-simulation paradox, Rogers and Cavanaugh (1983) concluded that conclusions made from experimental tests be examined carefully in clinical settings to identify the generalizability of results and conclusions. Future research related to this topic should be conducted to track characteristics of malingered audiograms as well as discrepancies seen in malingered audiograms if clinicians utilize the recommendations drawn from conclusions made during this study. Future research should also be conducted to identify the frequency of non-verbal and paralinguistic indicators of deception in patients who are successfully identified as feigning hearing loss. Finally, future research should be conducted on individuals who chose to exaggerate the severity of their hearing loss to identify common characteristics and strategies used by this population and how the characteristics and strategies differ from individuals without disordered auditory systems who choose to feign hearing loss.

Summary and Recommendations

Based on the results of this study, clinicians need to be aware that loudness memory is not the only strategy used by malingerers and should understand other commonly used strategies. It is also important to note that the degree of hearing loss indicated is subjective and varies based on what feels appropriate to the malingerer. Similarities in malingering strategies exist but strategies are adapted slightly to fit the specific task and the goals of the malingerer. It is important that clinicians try to increase their awareness of previous test experiences for suspected malingerers. It is also essential

to confirm the validity of flat audiograms given that most malingered audiograms have a flat configuration. Clinicians should repeat questionable audiograms to look for changes when the patient is evaluated with pulsed and continuous stimuli. Clinicians should be aware that decreased movement and avoidance of eye contact are the most frequent non-verbal indicators of deception during testing and clinicians should ensure consistency in the test battery when these behaviors are present in excess. Finally, it is important that clinicians understand that malingerers with an understanding of assessment procedures produce audiograms that are consistent with malingered speech reception thresholds more frequently than inexperienced malingerers. Thus, clinicians should use multiple methods to cross-check results.

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APPENDIX A

**INSTITUTIONAL REVIEW BOARD
APPROVAL LETTER**

UNIVERSITY of
NORTHERN COLORADO



Institutional Review Board

DATE: June 29, 2015
 TO: Sarah Thompson, B.S.
 FROM: University of Northern Colorado (UNCO) IRB
 PROJECT TITLE: [763909-1] Evaluation of Malingering Characteristics and Strategies during Hearing Assessment
 SUBMISSION TYPE: New Project
 ACTION: APPROVED
 APPROVAL DATE: June 29, 2015
 EXPIRATION DATE: June 29, 2016
 REVIEW TYPE: Expedited Review

Thank you for your submission of New Project materials for this project. The University of Northern Colorado (UNCO) IRB has APPROVED your submission. All research must be conducted in accordance with this approved submission.

This submission has received Expedited Review based on applicable federal regulations.

Please remember that informed consent is a process beginning with a description of the project and insurance of participant understanding. Informed consent must continue throughout the project via a dialogue between the researcher and research participant. Federal regulations require that each participant receives a copy of the consent document.

Please note that any revision to previously approved materials must be approved by this committee prior to initiation. Please use the appropriate revision forms for this procedure.

All UNANTICIPATED PROBLEMS involving risks to subjects or others and SERIOUS and UNEXPECTED adverse events must be reported promptly to this office.

All NON-COMPLIANCE issues or COMPLAINTS regarding this project must be reported promptly to this office.

Based on the risks, this project requires continuing review by this committee on an annual basis. Please use the appropriate forms for this procedure. Your documentation for continuing review must be received with sufficient time for review and continued approval before the expiration date of June 29, 2016.

Please note that all research records must be retained for a minimum of three years after the completion of the project.

If you have any questions, please contact Sherry May at 970-351-1910 or Sherry.May@unco.edu. Please include your project title and reference number in all correspondence with this committee.

Hello Sarah,

I concur with the first reviewer and congratulate you on a clearly written and thoroughly explained IRB application. You are approved and good luck with this fascinating research.

Sincerely,

Nancy White, PhD, IRB Co-Chair

This letter has been electronically signed in accordance with all applicable regulations, and a copy is retained within University of Northern Colorado (UNC) IRB's records.

APPENDIX B

PARTICIPANT CONSENT FORM



College of Natural and Health Sciences

Audiology & Speech- Language Sciences

Informed Consent for Participation in Research

University of Northern Colorado

Project Title: Evaluation of Malingering Characteristics and Strategies for Hughson-Westlake and Bekesy Audiometry

Researcher: Sarah Thompson, BS, Audiology and Speech Language Sciences

Research Advisor: Katie Bright, PhD. Audiology and Speech Language Sciences

You are being asked to participate in a study which will assess common strategies and characteristics observed during audiometric testing for an individual who is attempting to feign a hearing loss. Since the study will involve reading, comprehending and responding to questions written and spoken in Standard American English, as well as sitting for an extended period, please inform the researcher if you are unable to perform these tasks.

At the beginning of the session, you will be taken to a sound booth where the researcher will look in your ears with a lighted magnifier. The researcher will be checking to ensure that you do not have ear wax blocking your ear canal as this could impact the results of the study. You will be asked to complete a quick hearing test which will ensure that you have normal hearing and are eligible to participate in the study. You will then be given instructions on how to complete either the Bekesy tracking test or the Hughson-Westlake audiometric test. You will also be given a scenario to respond to during the test. You will complete a total of three tests during this portion of the study. After these tests are complete, you will be given instructions for a speech reception test. You will continue to respond to the scenario during this test. Finally, you will be re-instructed for the Hughson-Westlake test and will complete this test without responding to the scenario. Throughout the tests, an observer will accompany the researcher to take notes on the outcomes of the session. After this test has been completed, you will have the option to take a short break. Following the break, you will talk with the researcher to answer a few

questions about your experience during the test. The entire process should take between 60 and 90 minutes.

There are no foreseen risks associated with this study except possible discomfort sitting for extended periods of time during the test and possible stress when answering the interview questions.

All information pertaining to this study will be kept confidential. It will only be accessible by the student researcher and research advisor. A number will be assigned to your research instead of a name to increase confidentiality. The data will be stored in a locked, secure office and will be destroyed after three years.

Participation is voluntary. You may decide not to participate in this study and if you begin participation you may still decide to stop and withdraw at any time. Your decision will be respected. Having read the above and having had an opportunity to ask any questions, please sign below if you would like to participate in this research. A copy of this form will be given to you to retain for future reference. If you have any concerns about your selection or treatment as a research participant, please contact the Office of Sponsored Programs, Kepner Hall, University of Northern Colorado Greeley, CO 80639; 970-351-2161.

Participant's Signature

Date

Researcher's Signature

Date

APPENDIX C

TEST DIRECTIONS AND SCENARIO

Directions

You are about to be asked to complete a series of hearing tests. Throughout the upcoming tests, you will be asked to pretend to have a hearing loss in one ear. The researcher will let you know which ear has the pretend hearing loss. Please use the scenario below to help you decide how to respond to the hearing test. The way you respond is up to you. Please respond to each test as though you have just experienced the scenario below.

Scenario

You have been injured at work. You were hit in the head with falling equipment which caused a hearing loss in one ear. You filed a worker's compensation claim to cover your medical expenses and to receive benefits since your hearing loss makes it difficult to continue working. After a few days, your hearing begins to return. You are scheduled to visit the audiologist for an evaluation which will aid in your worker's compensation claim. You're scared that your supervisor will think that you lied about the injury. You also need the money from the claim so you are worried about being denied for your worker's compensation benefits. You were initially told that you have a 50% hearing loss in one ear. You decide to pretend like your hearing is still at 50% and you hope the audiologist cannot tell that it has returned to normal.

APPENDIX D**OBSERVER CHECKLIST**

Observer Checklist

Action	Observed (yes/no?)	Number of Times Observed
<i>Increased use of filler phrases</i>		
<i>Change in vocal pitch</i>		
<i>Increased time between phrases</i>		
<i>Avoidance of eye contact</i>		
<i>Slowed rate of speech</i>		
<i>Shifting of the body</i>		
<i>Increased movement of the hands, fingers or feet</i>		
<i>Decreased movement of the hands, fingers or feet</i>		
<i>Increased self-touches</i>		

APPENDIX E

INTERVIEW GUIDE

1. Do you believe that you were successful at pretending to have the hearing loss described in the scenario? Why or why not?
2. During the tests in which you had to press and hold the button as the tone changed, what strategies did you use to respond according to the hearing loss described in the scenario?
3. During the tests in which you had to press the button for each series of tones, what strategies did you use to respond according to the hearing loss described in the scenario?
4. How did your strategies change when the sound consisted of short bursts or pulses instead of being presented as a continuous sound?
5. What strategies did you use to pretend to have a hearing loss when you were asked to repeat words?
6. Please describe your previous experience with hearing tests?
7. If you have had previous experience with hearing tests, how did your experience with them impact the strategies you used to pretend to have a hearing loss?
8. Would your strategy have been different if you had been offered one million dollars to successfully pretend to have a hearing loss?
9. Did the strategies you used change over time as you took multiple tests?
10. Did you do anything else besides decide when to respond and when not to respond to convince the audiologist that you had a hearing loss?
11. If you were to complete the test again, what would you do differently to be more convincing?

APPENDIX F

AUDIOMETRIC TEST RESULTS BY PARTICIPANT

Participant	Bekesy Continuous Four- Frequency PTA	Bekesy Pulsed Four- Frequency PTA	Hughson- Westlake Four- Frequency PTA	Malingered SRT	Non- Malingered Four- Frequency PTA
01	50	61	64	55	8
02	23	23	23	15	9
03	29	29	28	15	16
04	55	50	45	20	5
05	34	31	30	10	8
06	45	65	69	50	5
07	31	34	30	30	4
08	60	71	78	55	5
09	74	76	80	55	1
10	17	18	18	10	6
11	50	60	58	55	9
12	24	26	43	35	13
13	67	68	68	65	9
14	49	57	59	55	8
15	44	39	36	40	-1
16	58	61	33	25	5
17	45	43	56	50	4
18	68	74	73	65	13
19	25	28	24	10	0
20	27	33	28	15	13

APPENDIX G

PARTICIPANT RESPONSES TO INTERVIEW QUESTIONS

Question I

Do you believe that you were successful at pretending to have the hearing loss described in the scenario? Why or why not?

Yes...um...I don't know why. I just felt like I was.

I believe that I was somewhat successful because like as I was going through, I was trying to like stop and start at the same types of levels. But I wasn't sure if I was supposed to be able to hear more when it's higher or lower and how that works and so it was sort of difficult to judge when I should start and stop.

I do because I had a strategy for each one. With the long tones where it was "hold the button until you couldn't hear it anymore" I would hold it for four seconds, release for four seconds, hold for four seconds, release for four seconds. For the tones, I would alternate or hold it for one, let two go, and then hold for another. So, pattern would be either alternating or one hearing it, two faking not hearing it, one hearing it.

Honestly no. I know you guys have ways to work around it but with what I tried to do, I would say yes? It was weird lying like you don't exactly know what you can and can't hear if you're faking it so how do you know if you're not supposed to be hearing it? So, that was the hardest part.

I think when I first started each test it was kind of hard because I was trying to find the pattern to make it sound like I had a fifty percent loss. Once I found the pattern it became a little bit easier but at first it was hard to do.

Yes, I do. I felt like I was responding at a level that was 50% but it got hard to remember which level was which.

I believe I showed a hearing loss but I don't know if it was a fifty percent hearing loss

For the most part, I think yes. I think I was consistent but in terms of being fifty percent, I don't know.

Yes. Because I knew that my UCL was about 85 so whenever the tone would reach just before it got uncomfortable, I figured that would be 65. I figured if my other ear was normal that would be loud enough for it to decussate and cross over to my good cochlea so I would be able to hear it even if I couldn't hear it in this ear. So, at any rate I would be able to hear it one way or the other.

I think so. I kind of just guessed as far as what I was supposed to do. I'm no expert in it so I'm not sure exactly how effective it was but I tried.

Overall I do think that I was successful. I do feel like my threshold levels changed between tests.

No because on the one where you hold the button down. I felt like it would stay the same for a while and I would mess up and press the button again. And with the words I was trying to figure out if I should say "What?" or if I should just not acknowledge that I heard it.

Yes, because I felt like I was good at picking the same loudness each time.

Yes, I think I was because I felt like I was able to pick out a good level for each frequency.

Because I did a good job.

I think I was partially successful but I think I could have improved by researching hearing loss before coming in.

I think I was more successful with Hughson-Westlake than Bekesy because I could attempt to count as we went along.

I would like to say yes except that I think my audiology knowledge is saying no. I was trying to fake what I thought was a flat loss and there's no way to know if the injury in the scenario would have resulted in a flat loss. I felt like I kept my responses consistent at a certain level but knowing what I know about faking and audiology I'm wondering if the person wouldn't have had a flat loss.

Yes, I feel like I could have faked a little less. I dragged it on a little bit longer than I wanted to.

I think so. I tried to guess what I could actually hear and then what felt about double of that.

Question II

During the tests in which you had to press and hold the button as the tone changed, what strategies did you use to respond according to the hearing loss described in the scenario?

I don't know. I just tried to remember where I responded before.

I tried to sort of pick about fifty/fifty, especially on the pulsing tones because I knew that like those came in intervals so you could sort of count about how many you were saying yes to and how many you were saying no to. Other than that, during the streams, like the consistent tone and then the first tone that we listened to, that was a little harder to decide like when exactly fifty/fifty would be to start and stop.

I would hold the changes, four seconds on and then four seconds off.

When you had the pulsing tones, I would try to count the tones and listen to it go up and down and I would try to hold it for like four counts down. And I did the same when it

was just the solid tone instead of the pulsing. I counted up and counted down to make it the same that I was listening to.

I would kind of remember when I pressed down, how loud the tone was. Then I counted 7-10 seconds depending on the tone then I went back up and I always went just a little louder than the tone I originally started with and I did that in a pattern.

I was thinking about what a really, really loud sound sounds like versus a regular speech sound. With a fifty percent loss, I probably can't hear all speech. I was trying to go a little bit above that but not really high where my ears hurt. And then I was trying to remember the sound in my ears when it would change.

I would respond to the first tone and then I would maybe respond to the second depending on the pitch. Then based on the two or three I missed I would respond to the next one. I could kind of tell by the intensity.

For the pulses, I counted some of them for the different frequencies. It would go "beep beep, beep beep beep" and then I would press it at a certain number of how many pulses went so I could do it the same at each frequency. And then I just counted seconds when I was holding it down, like "one two three, one two three."

The 85 threshold. And I tried to keep it, so I know I didn't respond at 2000 and 3000 so I tried to keep that the same between the pure tone and the pulsed tone.

I would start as soon as the tone went on and then I would stop responding while I could still hear it.

I tried to keep a level in my head where I felt like that would be a good threshold. I tried to remember it and then come back to it.

I closed my eyes so I could concentrate more on the sound. I was trying to pay really close attention to whether it was actually increasing or decreasing and I couldn't really tell sometimes.

I pressed the button down at the peak loudness every time and then held it down for about three to four seconds.

I waited until I felt like it was at the level of typical conversation. I didn't want to have to strain for it. Then I held the button until the sound got a little quieter and tried to match the same loudness each time.

I tried to gauge. I let the sound build up and then I would try to match where I responded each time.

I tried to wait until the sound was a little louder than I could really hear and then I pressed the button.

I tried to count the beeps. I don't know how successful that was but it was the only thing I was trying.

I was waiting until the sounds were loud enough so that I could hear a distortion in the signal. It wasn't my uncomfortable level but it was definitely a loud level so that I could hear a distortion. Then I was trying to mark a timed response down so the minute I pressed it I only held it for a four count or a three count or a five count. Then I would let go and I would re-count that to get back up the level I picked again and then I would press and hold it down for the same count.

I just waited a little bit and pushed the button. I'm not really sure why I pushed it when I did.

I just thought about the softest sound I could really hear and then I tried to double the loudness and pretended like that was the softest sound I could hear.

Question III

During the tests in which you had to press the button for each series of tones, what strategies did you use to respond according to the hearing loss described in the scenario?

I waited until it was definitely loud enough to hear but not like, so loud enough that it was hurting.

I tried to keep track of how many times I said I could hear it and how many times I couldn't hear and then sort of mix them up appropriately.

Wanting not to be really easy to see and just going every other, I mixed it up from going every other where I would hear it and then pretend to not hear it and then hear it, pretend to not hear it, pretend to not hear it, and then hear it on the fourth set.

I just tried to listen to see if the tone that you presented was the same or if it was lower. I would wait until it came up a certain amount to say that I heard it so that I knew that I had some room to go down.

I listened to more of the louder tones and when it got really quiet I stopped because for me the softer tones would be harder to hear anyway so I tuned those out. Then I tried to do a little bit better with the lower pitches than the higher pitches. And with the higher pitches, as they got softer I tried to pretend that they were hard to hear.

Same thing, just comparing a normal sound to a really loud sound

When I could tell it was getting softer I would let go. When I could tell it was getting louder I pushed it again. I thought that was more difficult.

Similar, I tried to count the beeps going up. And then as an audiology student I kind of know how it goes. But I think that you stayed at the same level instead of moving up five dB. So, I always paused. I would press the button and then you would go down and then it didn't sound like enough so I just waited.

Same thing, just trying to press before it got too uncomfortable. About when I could feel it.

I would respond about half of the time. If three or four were at the same level I would only respond to half of them.

Pretty much the same thing. Just tried to keep a level in my head, remember and come back to it.

I tried to mark a level and then remember it with each one but I did it with the deeper tones and the higher tones separately. Then I started to wonder if higher or lower tones would be easier to hear. So, I didn't know if I should hear more of the higher tones or less of the higher tones. So, I tried to mark them all at the same level of volume.

Once it got louder I could feel the sound. I judged my response based on how it felt rather than how loud it was. I tried to pick how it felt the same way every time.

I just tried to make sure that I matched how loud it was every time I pressed the button. I didn't want it to get any softer; I just tried to leave it at that level.

I did the same thing. I let the sound build up for a while then I just tried to remember the loudness and respond at the same place each time.

Same thing, waited until the sound was just a little louder than I could really hear and then pressed the button.

Just counting so I would respond four beeps up from wherever you started.

I was counting Hughson-Westlake in my head. I waited until you got to what I thought was 80 dB on most of them and then just followed the pattern. But I was also using the distortion of the signal in my ear.

I wanted to go up a beep, two between, and then push it for the next beep. There was no reason why, it's just what I picked.

I think I did the same thing. It was harder because there was time in between to forget how loud the last sound was.

Question IV

How did your strategies change when the sound consisted of short bursts or pulses instead of being presented as a continuous sound?

I feel like my responses like when I, were a little bit faster with the pulsed tone and the continuous tone was harder to know when to let go of the button.

I used a little bit more mathematic skills to solve those types of hearing scenarios to decide how much hearing loss I should have or shouldn't have. Otherwise, it was largely the same but I wasn't sure if it matters if I delay my response a little bit after the pulses. Like, does it matter if I press on the third beep or the first beep or like if it mattered where in the pulses I touched it, ya know? If that sort of affects reaction rate.

I used the four second strategy for both.

It was easier when it was the pulses because I felt like I could hear more of the tone change. So, I felt like I knew better when to let off or press the button whereas with the tones I had to try to keep count to see if I could hear the difference.

The pulses, I just had to pay attention to the pitch and whether they got softer or louder. I had to try to predict the tones and the pitch. So, I had to kind of plan out when I would let go and press it down. Versus the pulses where I wasn't sure what pitch it was going to be so it was harder.

They seem to get louder when they're continuous and seem to get softer when they're pulsed so I was really having to listen to them. My strategy didn't change I was just having to pay a lot more intention to the actual intensity levels.

I thought continuous was easier because you can hear it change more so than when there are pauses between. But I had the same strategy for both.

For the continuous one I didn't really have a strategy.

It didn't.

I think it was harder to pretend with a continuous tone. It was harder to keep track of where I was supposed to stop. It was mostly guesswork when I decided where to stop. I just stopped while I was still able to hear it.

I don't think that my strategy really changed. I just think that I was not as good with the continuous tones.

I don't think it really changed. I tried to mark a level of volume mentally.

It didn't really change much. I just held for three to four seconds after pressed the button initially.

I tried to keep the same strategy but it was a little harder when it was continuous because I couldn't really tell when it was getting louder.

No.

It didn't.

I had to go off trying to remember the level but that's really hard, especially for the different frequencies since I was trying for a flat loss. It was easier to count.

It didn't. I still used the counting and distortion of the signal.

They were different. The beeps were easier to press and keep track. The continuous made it more difficult to stop so I guessed more.

I don't think it did. I just used the doubling method.

Question V

What strategies did you use to pretend to have a hearing loss when you were asked to repeat words?

I just waited until I felt like it was about at the level that I would have come in with the pure-tones.

I would either mix up the words, some words I pretended like I didn't hear. Some words I really didn't hear but things like, I think maybe there was like "doorbell" in there and I said "doorman" instead, and like little things like that. I might like, if it had two parts to the word, I would mix up one part of the word.

Just tried to do every other. Tried to pretend to hear one and then not hear the next.

I tried to repeat some of the words funny. Like, I messed up some of the words and if they got too soft I would say I didn't hear it at all.

I tried to make the softer ones harder to hear. I had a harder time with this one. I tried not to hear the softer words and sometimes, like the beginning of words I wouldn't understand but I would hear the last part. Sometimes I would pick out letter sounds but I wouldn't hear the whole word.

Well, I feel like I was biased because I was trying not to respond the way normal malingerers wouldn't have. I feel like malingerers would often say partial words but I knew the words because I already have them in the back of my mind what they're supposed to be. But aside from that, I was going off of normal conversation level and acting like I couldn't hear it. And then when it got a little higher than that I was repeating the word back.

I knew the SRT had to be close to my threshold so I knew the first one I should be able to hear because it's presented above threshold. Then I tried to follow the Hughson-Westlake procedure.

Just when I thought it was loud. Since I have normal hearing, when it got loud I was assuming that's where they just barely heard it.

At that point I let it get to uncomfortable because I knew my word rec would be a little higher of a threshold than my pure tones so I tried to let that get to a little higher of a threshold and then I would respond.

Several of them I could probably have figured out and filled in the blanks even though I couldn't really hear it. I would have guessed more if I were taking the test for real.

I just let it get loud enough until I thought someone with a hearing loss could have that threshold and then remember it in my head.

I tried to mark a level of volume that I thought would be noticeable. But I struggled with figuring out whether I should be hearing parts of words or whether I shouldn't be hearing the words at all.

Same thing. I based it on the feeling and focused on the vibration.

I waited until I could definitely hear them loud. It sounded like someone was clearly talking to me.

Just remembering the loudness and trying to match it.

Same as with tones, waited until it was a little louder than I could really hear.

At first I wasn't responding and then I would say half of the word.

I waited until the word got to a loud enough point that I could hear the distortion in the signal.

I said the ones that were much louder than necessary to hear and then didn't respond when they were softer.

I used the doubling method and sometimes said half of the word.

Question VI

Were your strategies different when you responded to tones rather than words?

I guess I had to think a little bit harder for the words, like concentrate, like sort of like think quickly like response time. Like, how should I change this word to make sure I didn't hear it now? Like I also had my eyes opened when I was doing the words. Like with the other tones I felt like it was easier to keep track of like what I was hearing with my eyes closed.

Yes. Because the words I was just more consistent and did every other.

I would have tried to find something that maybe wasn't as random.

If the words were too soft I just wouldn't answer but otherwise I don't think the strategies changed.

With the words I had to focus more because that one was harder for me to fake because sometimes it was hard to hear the words at times. So, trying to think of a word that was wrong but still made sense was hard. Versus the pulses I could kind of figure out a pattern.

No.

No.

Yes.

Yes and no. I used that baseline of 85 and I tried to let it get to that point when it was words.

No.

No I don't think so. I tried to let my words get a little bit louder.

No not really.

No.

Not really. I tried to do the same thing where I waited until I wasn't straining to listen to it.

No.

No.

Overall the same, just trying to count presentations to stay at the same level.

No.

Yes. The tones were easier to respond to.

They were pretty similar.

Question VII

Please describe your previous experience with hearing tests.

I'm an audiology student. I've given hearing tests. I've had many of them.

I don't think I've had a hearing test since definitely high school, but maybe middle school. I remember having a lot more hearing tests in elementary school. They would all call us down and we would listen to the tones and they would just be like your

preliminary test to make sure I was qualified. I think that's pretty much all they did when they did hearing tests.

The last time I had a hearing test was probably in elementary school. I had to hear tones on either side and hit the button if I could hear it.

I've had my hearing tested but I have never tried to lie before.

Not a lot, just the normal tests in school and screening at a doctor.

I have a lot of experience with hearing tests. I'm an audiology clinician.

I'm an AuD student at the University of Northern Colorado. I have seen hearing evals but have not seen the continuous beeps yet. But in classes we've learned about the typical procedures and some strategies used to rule out malingering.

As an audiology graduate student I have a lot of experience. I've done many and been the participant many times.

I'm an audiology grad student so I've done tests and had my hearing tested.

Basic hearing test done a couple years ago. This is the second time I've had my hearing checked.

I have quite a bit of experience giving and getting hearing tests.

No experience.

I've had many of them. I'm a third year audiology student.

I've had a lot of them so I know the procedure.

I'm an audiology grad student.

Just screenings at school.

I'm an audiology student.

I give them and I take them. I'm a second year audiology student and I've done three semesters of clinic.

I don't have any.

I don't really have any.

Question VIII

If you have had previous experience with hearing tests, how did your experience with them impact the strategies you used to pretend to have a hearing loss?

I think knowing about the Hughson-Westlake was helpful because I knew when to press the button again. And knowing how the Bekesy tracking works was a little bit helpful too.

Sometimes I wasn't pretending, I did struggle with the words so that one was easier to fake because I couldn't hear it. With the pulses, those were kind of familiar to me so I could use that previous experience to figure out the different patterns.

No, I think like I every hearing test you sort of wonder like how well you're doing because they don't necessarily tell you in the middle of the test. So I don't know like how high should I be hearing or is this just blank space where I just really should not be hearing anything at all. So, I guess that's just like a consistent question whether it's a regular hearing test or you're trying to do your trial.

It's hard to say. I think that test probably had more social pressure to pretend to hear more because in elementary school you want to have the best hearing and the best eyes. Whereas here it was a very conscious decision to not hear, or not indicate that I was hearing everything that I could. So instead of trying to overcompensate there was an under compensation.

I know audiologists present some tones softer and some tones louder but I don't think I really applied that to this.

A lot. Aside from just thinking about loud versus soft sounds I was also trying to think about the fact that the changes in frequency dictate the level of loudness that you perceive and that it's easier when it's lower pitched. And with speech I knew the words already and I knew that the level I should be responding should be close to the level I was responding to for pure tones. So, I tried to remember that but it was really hard to remember the level for tones when you forget after all of the tones are presented into your ears.

Greatly because I knew the procedure so I could kind of judge how the procedure was going while I was trying to fake.

I think by knowing at least the Hughson-Westlake, I could kind of determine what you were doing. If you were doing the typical way I assumed you were starting at thirty. If I didn't respond you went up to fifty. So, I was guessing that way since I knew the process.

I knew you would be using Hughson-Westlake for pure tones so I counted starting at 20 to 30, 40, and I started pressing the button at what I thought was 60 or 70.

I think I knew what to expect more. It would be harder to take it if I had never had my hearing checked before.

I think that giving and getting hearing tests made me think of what type of hearing loss I was trying to portray. I tried to do a high-frequency hearing loss to get a fifty percent

hearing loss instead of doing what I think other people would do which is to do a flat hearing loss.

Knowing that you're going to go down 10 dB, up 5 dB. I used that to predict how loud the sound was getting. Knowing the procedure helped me pick where I wanted to be on the audiogram.

Since I've had the tests done before, I know what my threshold is and what it sounds like when I'm listening at threshold. Since I have normal hearing I figured that if I let the sound get quite a bit louder than that then it would at least be close to the hearing loss.

It helped a lot because I knew about how loud a sound would have to be to be heard by someone with a hearing loss and then I tried to match that.

I don't think it did.

We know that Hughson-Westlake typically starts at 30 dB. So, since I know the procedure I could gauge the presentation levels and estimate how loud the sounds were and whether to respond.

I knew to listen for a distortion in the signal when it gets to a certain level. Down ten up five.

I don't have any experience.

Question IX

Would your strategy have been different if you had been offered one million dollars to successfully pretend to have a hearing loss?

Uh, I don't think so. I'd really like fifty thousand.

Well, I feel like you wouldn't want to pretend like you have more of a hearing loss. Like you wouldn't want to ham it up just because there's a million dollars involved. Because if you all of a sudden have forty percent hearing loss instead of fifty percent hearing loss where they expect you to be on the mend or something like that. That could still be like another red flag so I would probably stick with the same strategy, just try to like keep it up a little more.

I would probably have kept the same strategy for the press and hold. I may have tried to find a pattern in the bursts to make it more consistent.

I probably would have done more research on how to lie on a test and my strategy would have changed according to that. I may have tried for more of a hearing loss.

Probably. That's a pretty good incentive but, I don't know, it's hard to fake because you have the urge to press the button when you hear it so I don't know if I'd necessarily get away with it.

No. I don't think so, no. I did my best.

I probably would have studied more. I may have waited longer to respond.

Yeah I would have practiced if I was that person in the scenario and that's what I really wanted. If I had no experience with hearing tests I probably would have googled it and looked up exactly what they do and been prepared.

No.

I might have tried harder but not really.

No.

I think that was my hardest effort so I think I would have done the same thing.

Probably. I probably would have pushed it more. I would have let it get really loud. I stopped it before it was too loud but I probably would have let it go.

I think I would have had the same strategy but maybe would have let it go loud enough just so it was definitely at a very high level.

Probably not. I think I would do the same thing.

No probably not. I think my strategy was pretty good.

No.

No because I had forgotten about the amount of money that was at stake and was just trying to fake a consistent hearing loss.

I think the strategies would be the same but I would have tried to be more accurate.

I don't think so. I think I would still use the doubling.

Question X

Did the strategies you used change over time as you took multiple tests?

Ya I think they did. Um, I think I just kind of like re-evaluated like what level I was at cuz I feel like I was like really high, like my thresholds were super high for the pure-tone test and for the Bekesy I tried to, I don't know, I don't know how they changed. At first I was like holding the button down for a really long time with the Bekesy and then I realized that I should hold it down for a shorter amount of time. Things like that.

I don't think they changed but I may have refined them a little bit and gotten the hang of listening and when to pick up my finger and when to put it down.

They changed between the tests but not within the test.

No I tried to stay consistent so my results would look consistent.

No I don't think so.

No. Stuck to the same one.

Not exactly. I think maybe, if I would have known more about what being hit in the head, what kind of hearing loss it would have produced, I maybe would have tried to make an audiogram look more like that. I didn't know if the configuration should have high frequencies or low frequencies but I did it pretty much flat all the way across. I don't know if that's how it showed up.

No, it was boring when I could obviously hear them but I was waiting to pretend to hear. I was trying to act bored because that's what people do. They get bored and look around. So I was doing that.

I forgot to not respond to one and two thousand later on in the test, or whichever two I wasn't responding to.

Not really. I continuously stopped responding while I could still hear the sounds.

No I just think I wasn't as good with the continuous tones.

Yes. When I first started I was haphazardly pressing so then I started closing my eyes and concentrating more on what I was hearing.

No.

Not really. I tried to keep the same strategy to keep it consistent.

No I don't think so.

No not really.

I tried to keep them consistent but each test was so different that I had to adapt.

No.

Yes. The beeps to the steady stream were different strategies.

No I always used the doubling.

Question XI

Did you do anything else besides decide when to respond and when not to respond to convince the audiologist that you had a hearing loss?

No.

When you were asking me the words, it was sort of a fifty/fifty, like sometimes I was genuinely guessing and sometimes I would make the words sound like questions, like “hotdog?” like I don’t know if that would be something you would take into account but I would pretend like it was a question, like I was more unsure or not unsure of hearing it.

I would say that I didn’t look into the window. I was looking away most of the time so there wasn’t a lot of direct eye contact.

No because as far as I know it just matters whether you say you can hear it or not. There’s not much more you can tell an audiologist besides whether you’re hearing.

I tried to pause when I answered to question if I heard it or not. I know I had some delayed responses at times to pretend like I was thinking about whether I could hear it.

I was trying to act like, “uh just chilling because I can’t hear it” and then I tried to act like, “Oh!” when I would hear it. So yes, with my eyes and my body language I was trying to keep you from watching me and observing me.

No.

I probably would have made my levels higher for the Bekesy par. I feel like when it’s ascending you don’t quite know what level you’re at. So, I don’t know if what I got is what think a fifty percent hearing loss would be so I would maybe wait a little bit longer.

I pretended that I couldn’t hear when you were giving directions.

I tried to keep my facial expressions as dead-pan as possible.

No I just tried not to look at you.

No.

No I didn’t do anything else.

I tried to avoid making eye contact with you.

No not that I can think of.

I don’t think so.

I made you turn up the talk forward at the very beginning of the exam.

No. I just tried to make them equal.

I tried not to look at you so you couldn’t tell that I was faking.

Question XII

If you were to complete the test again, what would you do differently in order to be more convincing?

I don't know. Maybe on the SRT thing I would make it like half the words or be like "What? I don't understand" because I just didn't respond at all.

I might say I heard a little bit less because I felt like I was around, maybe in the sixty percent hearing range, possibly, I'm not sure. I might possibly say that I heard a little bit less but other than that I think I would stay about the same.

With press and hold I would have continued the same strategy with a certain amount of time on and a certain amount of time off. With the bursts, I think I would have potentially try to find a more consistent strategy instead of doing the alternating and the 1-2-1.

I would research how to lie on one of these tests and some strategies you can use to get through it. I would be more educated about how to lie properly. Because you can't really come into this and know how to lie successfully without challenging yourself to know.

I would have stopped sooner with some of the higher or lower pitches. When it got softer I might have stopped sooner.

Not much other than maybe, well I was trying to catch onto the pattern and repetition of the test so maybe trying to pay less attention and just think about the actual sound and where I need to respond. So just stop thinking about it and actually listen.

I probably could have done more actions besides actual testing to be convincing that I had a hearing loss.

I can't think of anything.

Keep them the same. If I didn't respond to one and two, remember not to respond to one and two on the other tests.

Probably would have reviewed hearing tests more to know what strategies I should use.

I would try to make the continuous tones more consistent with the pulsed tones.

Nothing.

When you came over to give me directions I probably would have said that you weren't loud enough or that I couldn't hear you.

Probably pretend

I would probably read about strategies that were successful or not successful so that I could come in with a plan instead of making something up on the spot.

Maybe just let the sound get a little louder before saying I could hear it.

Probably wait longer to respond to show that I truly had a hearing loss, especially with the words.

Tried to fake non-flat hearing loss and be more sloping. Not sure what configuration is consistent with the injury in the scenario.

I would let go earlier.

I don't think so.